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The impact of substantiated childhood maltreatment on young adult health: a cohort study

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Abstract

Introduction: Childhood maltreatment is a widespread public health problem. Associations between childhood maltreatment and later psychosocial, mental health and physical health outcomes have been widely reported. The limitations of previous studies include: (i) reliance on cross-sectional designs that use self-report measures of childhood maltreatment, (ii) reliance on clinical and/or highly selective community samples with the consequent possibilities of recall, help-seeking, or rumination bias, (iii) tendency to focus on a specific type of childhood maltreatment, particularly sexual abuse, with less emphasis on physical and emotional abuse and neglect, (iv) the fact that few studies have examined the independent effect of single and multiple forms, as well as multiple incidents, of childhood maltreatment, (v) a failure to adjust for other forms of childhood maltreatment that often co-occur and (vi) limited efforts to control for potential confounders. These confounders include individual and familial sociodemographic characteristics, psychopathologies and environmental disadvantages, as well as perinatal, childhood and adolescence developmental problems. There are few, if any, previous studies with prospectively collected data and with substantiated cases of specific and co-occurring childhood maltreatment using a population-based sample to determine whether childhood maltreatment predicts later health outcomes, controlling for relevant confounders.

Aim

To investigate life course health consequences of exposure to substantiated childhood maltreatment

Objectives

1. To determine whether childhood maltreatment predicts subsequent intimate partner violence (IPV) victimisation, delinquent behaviours, risky sexual behaviours (RSBs) and adverse pregnancy outcomes in young adults.
2. To determine whether childhood maltreatment predicts subsequent substance use and mental health disorders.
3. To determine whether childhood maltreatment predicts subsequent physical development and physical health.
4. To assess the impact of childhood maltreatment on the quality of life (QoL) of young adults.

Methods: This study prospectively examines the associations between substantiated childhood maltreatment (ages 0–14 years) and IPV victimisation, delinquency and RSBs, as well as substance use, mental health, physical development, physical health and QoL of children at the 21-year follow-up. Data are from the Mater-University of Queensland Study of Pregnancy (MUSP), an Australian pre-birth longitudinal cohort of mothers and their children. Pregnant women were consecutively recruited at their first prenatal/antenatal clinic visit (FCV) at the Brisbane's Mater

hospital in the years 1981–83. Survey data were linked with substantiated cases of childhood maltreatment reported to child protective services (CPS) between birth and 14 years of age. The MUSP is the only Australian birth cohort study and one of the few prospective studies done internationally, with the capacity to track multiple outcomes following substantiated childhood maltreatment, controlling for a wide range of confounders/covariates.

Results: Those children who had experienced most forms of substantiated childhood maltreatment, that is, who were physically and/or emotionally abused, and/or neglected were more likely to report (i) multiple IPV victimisations and delinquency; (ii) RSBs and adverse pregnancy outcomes; (iii) injecting illicit drugs and cannabis use disorders; (iv) delusions, hallucinations and psychosis; (v) height stunting, high fat intake, asthma and sleep disorders; and (vi) poorer QoL than their nonmaltreated counterparts. Those exposed to multiple forms, or incidents, of childhood maltreatment also had an increased likelihood of adverse psychosocial and health outcomes. Sexually abused children experienced higher levels of physical IPV victimisation and manifested increased cumulative RSBs.

Conclusions: There was an association between childhood maltreatment and a broad range of later psychosocial problems, adverse reproductive health outcomes, substance use and mental health disorders, as well as worse physical development, poorer health and QoL. The study found that childhood maltreatment, namely physical and emotional abuse and neglect, predicted a significantly increased risk of adverse health consequences. The study also found multiple adverse health outcomes in children who experienced substantiated childhood maltreatment while controlling for a range of confounders. The vast majority of children, having experienced childhood maltreatment, however, did not appear to exhibit adverse outcomes. The reasons for the variable health consequences of childhood maltreatment are unclear. Further research to identify possible pathways from childhood maltreatment to later outcomes and resilience is warranted.

Declaration by author

This thesis is composed of my original work, and contains no material previously published or written by another person except where due reference has been made in the text. I have clearly stated the contribution by others to jointly-authored works that I have included in my thesis.

I have clearly stated the contribution of others to my thesis as a whole, including statistical assistance, survey design, data analysis, significant technical procedures, professional editorial advice, financial support and any other original research work used or reported in my thesis. The content of my thesis is the result of work I have carried out since the commencement of my higher degree by research candidature and does not include a substantial part of work that has been submitted to qualify for the award of any other degree or diploma in any university or other tertiary institution. I have clearly stated which parts of my thesis, if any, have been submitted to qualify for another award.

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Publications during candidature

Peer-reviewed papers

1. **Abajobir AA**, Kisely S, Williams GM, Clavarino AM, Najman JM. Substantiated childhood maltreatment and intimate partner violence victimisation in young adulthood: a birth cohort study. J Youth Adolesc. 2017;46(1):165–79.
2. **Abajobir AA**, Kisely S, Williams G, Strathearn L, Clavarino A, Najman JM. Gender differences in delinquency at 21 years following childhood maltreatment: a birth cohort study. Pers Individ Differ. 2017;106:95–103.
3. **Abajobir AA**, Kisely S, Maravilla JC, Williams G, Najman JM. Gender differences in the association between childhood sexual abuse and risky sexual behaviours: a systematic review and meta-analysis. Child Abuse Negl. 2017;63:249–60.
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6. **Abajobir AA**, Najman JM, Williams G, Strathearn L, Clavarino A, Kisely S. Substantiated childhood maltreatment and young adulthood cannabis use disorders: a pre-birth cohort study. Psychiatry Res. 2017;256:11–23.
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1. **Abajobir AA**, Kisely S, Williams G, Najman J. Gender differences in injecting drug use following childhood abuse and neglect in young adulthood: a prospective population study. In: Irwin CE, editor. Abstracts of Society for Adolescent Health and Medicine (SAHM) Annual Meeting. Proceedings of SAHM 2018 Annual Meeting; 2018 March 14–17; Seattle, USA. Seattle, USA: J Adolesc Health; 2018. p. S137–S138.
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5. **Abajobir AA**, Kisely S, Williams GM, Clavarino AM, Najman JM. Substantiated childhood maltreatment and intimate partner violence victimization in young adulthood: a birth cohort study. Paper presented at: The 28th Ethiopian Public Health Association (EPHA) Conference; 2017 February 19–22; Harar, Ethiopia.
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Publications included in this thesis

Publication 1 (Abajobir AA, Kisely S, Williams GM, Clavarino AM, Najman JM. Substantiated childhood maltreatment and intimate partner violence victimisation in young adulthood: a birth cohort study. J Youth Adolesc. 2017;46(1):165–79) – incorporated in Chapter 4.

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Contributions by others to the thesis

No contribution by others.

Statement of parts of the thesis submitted to qualify for the award of another degree

None.

Research Involving Human or Animal Subjects

The Human Ethics Review Committees of the Mater Misericordiae Mothers' Hospital (MMMH) and the UQ approved the study (UQ BSSERC number: B276). Consent forms were signed by mothers, for themselves and their children, up to the 14-year follow-ups, and then by offspring at the 21-year follow-up. Data were coded for confidentiality. Ethical approvals were previously obtained from the Mater Children's hospital and UQ Ethical Review Committees for the original Department of Families, Youth and Child Care Queensland (DFYCCQ) data collection and its linkage with the MUSP cohort at the 14-year follow-up [UQ BSSERC number: 2012001058]. Ethical approval was also obtained from the Human Ethics Review Committee of the UQ to extend the data linkage to the 21-year follow-up (UQ BSSERC number: 2015001524). See Appendix 6.

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Keywords

substantiated childhood maltreatment, life course outcomes, psychosocial behaviours, substance use, mental and physical health outcomes, logistic regression, birth cohort study

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Table of Contents

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List of Abbreviations or Acronyms

ADHD	Attention Deficit/Hyperactivity Disorder
ASPD	Antisocial Personality Disorder
BMI	Body Mass Index
CAS	Composite Abuse Scale
CBCL	Child Behaviour Checklist
CDC	Centres for Disease Control and Prevention
CES-D	Centre for Epidemiological Studies Depression Scale
CIDI	Composite International Diagnostic Interview
CI	Confidence Interval
CPS	Child Protective Services
CSA	Childhood Sexual Abuse
CTS	Conflict Tactics Scale
DFYCCQ	Department of Families, Youth and Child Care Queensland
DSM	Diagnostic and Statistical Manual of Mental Disorders
DSSI	Delusions-Symptoms-States Inventory
DV	Domestic Violence
FCV	First Prenatal/Antenatal Clinic Visit
FEF	Forced Expiratory Flow
FEV1	Forced Expiratory Volume in 1 second
ICC	Intraclass Correlation
ICD	International Classification of Diseases
IDU	Injecting Drug Use
IPW	Inverse Probability Weighting
IPV	Intimate Partner Violence
ISSI	Interview Schedule for Social Interaction
LES	Life Events Scale
MMMH	Mater Misericordiae Mothers' Hospital
MSP	Multiple Sexual Partner
MUSP	Mater-University of Queensland Study of Pregnancy
NLE	Negative Life Event
NPV	Negative Predictive Value
OR	Odds Ratio
PDI	Peter's Delusions Inventory

PPP	Positive Parenting Programme (Triple P)
PPV	Positive Predictive Value
PRISMA	Preferred Reporting Items for Systematic Reviews and Meta-Analyses
PSQI	Pittsburgh Sleep Quality Index
PTSD	Posttraumatic Stress Disorder
QoL	Quality of Life
RSB	Risky Sexual Behaviour
SD	Standard Deviation
SES	Socioeconomic Status
SFQ	Short Fat Questionnaire
STI	Sexually Transmitted Infection
UQ	University of Queensland
WHO	World Health Organisation
YASR	Achenbach's Young Adult Self-Report
YSR	Youth Self-Report

Chapter One – The Purpose of the Present Study

The public health importance of childhood maltreatment

Exposures to childhood adversity and trauma, in general, and childhood maltreatment, in particular, threaten the health and development of children globally (1, 2). Childhood maltreatment includes sexual, physical and emotional abuse and neglect (3, 4), as well as a wide range of other forms of maltreatment. Childhood maltreatment predicts poor developmental and health outcomes in later life (4, 5), and forms part of a broader constellation of life course determinants of health (6). For example, some studies suggest that individuals who are exposed to childhood maltreatment have a greater propensity to develop a wide range of developmental, psychosocial and health problems (7-11). These include tobacco addiction, alcoholism and drug abuse (9, 12-15), risky behaviour, criminality (9), personality disorders (16) such as emotionalism (17, 18), compulsiveness (19-21) and earlier manifestations of these outcomes (22). Moreover, childhood maltreatment might lead to posttraumatic stress disorder (PTSD) (11, 20), depression (7, 8, 11, 23) and anxiety (7, 11, 23), as well as other psychopathologies (24), psychiatric conditions (23) and suicidal tendencies (7) into adulthood. Maltreated children are also more likely to engage in RSBs as adults (25-27), become obese (28-32), develop other cardiovascular (33, 34) and respiratory pathologies (35, 36), as well as be at risk of negative markers of physical health conditions (37) and premature mortality (38, 39). In addition, childhood maltreatment has been found to affect academic performance (40), cognitive (17, 41) and executive functions (42), and is associated with lower economic wellbeing at both individual (43) and societal (44, 45) levels.

However, uncertainty surrounds the area of health impacts of childhood emotional abuse and neglect (2, 9, 46-50), especially when multiple incidents or chronic maltreatment occur (50), with the impact of sexual abuse dominating the literature (2). Childhood neglect mostly co-occurs with other forms of childhood maltreatment, particularly with emotional abuse (51); that is, it may have additional effects or its effects may be hidden by other forms of maltreatment. Lack of specific definition and typology (51), lesser attention to omission as compared to commission (51, 52), as well as subsequent misclassification, underreporting (51), subtle (51, 52) and less perceived immediate effects (53) with arbitrary threshold levels (52), may contribute to the dearth of research on the impacts of childhood emotional abuse and neglect (50-52). Moreover, the identification of these forms of childhood maltreatment relies heavily on reports of caregivers' mistreatment (52), which can be misclassified or go unrecognised by CPS workers (51). Despite their under-recognition, however, these forms of maltreatment (i.e., emotional abuse and neglect) may have more longstanding, negative consequences on cognitive and psychosocial development (54, 55) as compared to abuse experiences. As a result, neglect may involve ongoing, chronic incidents across

the lifespan, with a possible accumulation of harm (48, 52, 53). This may also be partly explained by persistent harsh patterns of parenting, independent of underlying poverty (51), and coexisting medical neglect. This uncertainty is complemented by a need for well-established, longitudinal evidence generated from mother-child linked data to adequately characterise the life course effects of each type of substantiated childhood maltreatment.

The public health importance of childhood maltreatment has been increasingly recognised, largely because of the necessity to more clearly determine potential life course health outcomes (56, 57). In view of the public health importance of the problem (58), Australia has developed a 12-year (2009–20) streamlined National Framework with shared responsibility (59) among stakeholders concerned with preventing childhood maltreatment. Despite this plan, there is little population-based research on whether poor developmental patterns and health outcomes are more common among those exposed to childhood maltreatment. The present study is among a handful of studies in the UK (60-62) and USA (31, 63-69) that have collected prospective data on maltreatment in childhood and the adolescence period, developmental markers, and mental and physical health outcomes at different phases of the life course. The current study is unusual in that it tracks multiple outcomes throughout childhood, adolescence and young adulthood. These include psychopathology, RSBs and pregnancy outcomes, substance use and mental health disorders, poor physical development, physical health and overall QoL. It also controls for a wide range of confounders/covariates on maternal and child sociodemographic characteritics, maternal lifestyles and mental health, as well as childhood and adolescence developmental problems. The study uses anonymously and confidentially linked prospective records of substantiated childhood maltreatment. The present study provides an empirical test intended to assess the early adult health impacts of the spectrum of childhood maltreatment.

The benefit of longitudinal, epidemiological studies on childhood maltreatment

Despite the potential for negative consequences, little is known about the health impacts of specific and multiple forms of substantiated childhood maltreatment (56, 57). There are a number of generally relevant cross-sectional studies that point to adverse outcomes. However, findings from these studies are limited by the potential for recall bias (70, 71), their focus on a few specific types of childhood maltreatment (despite the fact that most childhood maltreatment experiences co-occur) (72-77) and the use of clinical rather than population samples. Few previous studies have had an appropriate level of control for potential confounding. The limited effort to control for potential confounders is of particular concern given that childhood maltreatment and later adverse health outcomes may share some common antecedents including individual sociodemographic characteristics (9). These include factors such as perinatal birth outcomes (78, 79), and ill-health in

childhood (80), adolescence (81) and adulthood (82). There may also be shared risk factors, as well as familial sociodemographic characteristics (81), psychopathologies (83) and environmental disadvantages (81). Moreover, retrospective reports of life course adverse exposures can change over time depending on resilience, recovery (84) and severity of the exposures. In cross-sectional studies, childhood maltreatment might be both a cause and effect.

The findings from a handful of prospective studies are inconsistent and generally involve samples that are not representative of the broader population (37, 85). These studies focus on a selected set of sociodemographic characteristics (e.g., female) (86), maltreatment types (e.g., sexual abuse) (9) and negative outcomes in late adulthood (9, 22, 31, 63, 64, 66-68, 87). They have also exclusively focussed on a limited number of outcomes including psychosocial disorders (88) and RSBs (67) in clinical samples (89-91), that are liable to selection bias. Hence, there is a need for a better understanding of potential long-term adverse effects (92, 93) using a multi-wave research design (36, 77, 93, 94) that controls for confounders (95). Such a study needs to distinguish the effects of childhood maltreatment (95) and guide the development of appropriate intervention strategies (93, 96) in different environmental settings (77).

In this study, using a multi-wave prospective longitudinal research design, we have investigated a broad range of young adult adverse health outcomes of children who experienced substantiated childhood maltreatment. The MUSP is one of the few longitudinal studies that have investigated the life course consequences of childhood maltreatment, controlling for prenatal and postnatal, as well as childhood, adolescent and adult confounders and/or covariates (77). This includes the types, age and frequency, of childhood maltreatment substantiations as a predictor of potential adverse outcomes (76). This study extends our understanding of the long-term health consequences of early childhood maltreatment, with the advantage of follow-up from pregnancy to adulthood and with the advantage of repeated measurements. The findings will provide an empirical basis for relevant health care policy improvement and for integrated, developmentally appropriate child and adult health services. Each chapter in the Results section specifically discusses the importance of using a robust study design such as a longitudinal study. Each chapter also describes a range of statistical approaches that address the nature of childhood maltreatment and its subsequent impact while acknowledging the limitations inherent in the current study.

Thesis outline

This PhD thesis builds on prior findings, largely cross-sectional, of the negative consequences of childhood maltreatment. It provides an opportunity to test a variety of hypotheses and tests the findings of a range of cross-sectional studies, using longitudinal measures of substantiated cases of childhood maltreatment as predictors and their hypothesised health outcomes.

Chapter one discusses the public health importance of childhood maltreatment, with a particular focus on longer-term outcomes. It highlights the methodological limitations in the field while exploring the potential advantages of an epidemiological longitudinal study design. This chapter also emphasises the empirical basis of having population-based data from mother-child dyads across different stages and spheres of later life. Chapter two briefly describes the available knowledge in the field including the discussion of relevant concepts, types and measurements, as well as magnitude and health outcomes of childhood maltreatment. This chapter also explores some measures of maltreatment (e.g., severity indicators) relevant to predicting later health outcomes.

Chapter three describes the MUSP study design and measurements contained in this study, including data linkage with child protection agency records and the process of maltreatment substantiation. Chapters four to seven present the findings of a number of published papers. There are twelve published papers in total. These specifically concern adult outcomes of childhood maltreatment, particularly psychosocial, RSBs and pregnancy outcomes, as well as substance use and mental health disorders, physical development, physical health outcomes and overall QoL. Chapter four deals with the associations between substantiated childhood maltreatment and IPV victimisation and delinquency, as well as RSBs and pregnancy outcomes. Chapter five deals with injecting drug and cannabis use disorders, as well as psychotic experiences and psychosis. Chapter six involves outcomes such as stunting of height, high dietary fat intake, asthma and lung function, and inadequate sleep, while chapter seven presents details of the QoL following childhood maltreatment. Finally, chapter eight highlights the common themes across published papers and discusses the significance of those findings. It also presents future study directions and pragmatic suggestions on the health impacts of childhood maltreatment for concerned stakeholders. Finally, there are some concluding remarks. All published articles include all relevant sections, and thus, there is some repetition, for example, in relation to methodology, in each paper and each chapter.

Chapter Two – Literature Review

Concepts and types of childhood maltreatment

There is no internationally agreed definition for childhood maltreatment (97). Childhood maltreatment involves a variety of acts of commission and/or omission (98). Childhood maltreatment is usually considered to encompass four types of experiences–(1) sexual abuse (2) physical abuse (3) psychological or emotional abuse and (4) neglect (physical, emotional, supervisory or medical)–and usually perpetrated by a parent or other caregiver to a child under 16 or 18 years of age (99, 100). According to the Diagnostic and Statistical Manual of Mental Disorders (DSM-5) and International Classification of Diseases (ICD-11), childhood sexual abuse (CSA) involves a penetrative or nonpenetrative sexual act that provides sexual gratification to the perpetrator. Childhood physical abuse involves a nonaccidental physical injury, ranging from bruising to fractures or brain injury. Childhood emotional abuse involves a pattern of behaviour toward the child such as verbal abuse, intimidation or manipulation that may result in significant psychological harm to the child. Childhood neglect is a failure to respond appropriately to a child's basic age-appropriate needs (101). It may include physical neglect which is the failure to provide basic physical needs such as food, clothing and shelter; or emotional neglect that involves the failure to appropriately respond to feelings of the child including inattentiveness, absence of love and affection, and lack of supervision (99).

Classifications of childhood maltreatment

Two distinct schemes tend to be used to classify childhood maltreatment experiences (76). First, the Hierarchical Type considers the occurrence of childhood maltreatment experiences based on perceived importance in descending order from sexual abuse, physical abuse, to neglect and emotional abuse. The *hierarchical* (76) or *differential* (102) effects model is intended to distinctly assess the consequences of each type of childhood maltreatment. The major methodological limitation of previous studies is distinguishing each form of childhood maltreatment as they frequently co-occur. Few victims experience one type of childhood maltreatment in isolation (103). Sexual abuse dominates the literature, partly due to its perceived severe developmental consequences as well as its implications for offending public moral standards. At one level, sexual abuse is easily operationalised, with some clearer characteristics than other forms of maltreatment (2). These factors may contribute to the higher rates of attention and disclosure for sexual abuse experiences, although there may be ongoing secret perpetrations. By contrast, the magnitude of other forms of maltreatment, such as neglect, is not easily measured or well estimated globally (2). That said, it may be important to use documented maltreatment experiences complemented with strong methodological designs to explore each form of childhood maltreatment (104), including

adjusting for co-occurring forms of childhood maltreatment to disentangle the independent effect of each form of maltreatment (105, 106).

However, it may be difficult to distinguish the effects of each form of childhood maltreatment as many children experience multiple forms of maltreatment (104) concurrently and/or sequentially. Thus, the second scheme, the *general* (multiple) effects model, is used to address *polyvictimisation* and subsequent developmental outcomes (76, 107, 108). This latter scheme acknowledges the possibility of co-occurrence (72, 77) and/or *polyvictimisation* (74, 109, 110). *Polyvictimisation* is also referred to as *multitype* childhood maltreatment (72) and reflects the overall overlap between (46, 74, 111, 112) and correlation of each form of childhood maltreatment (77, 111). These models can be summarised as the *expanded* (76) or *general* effects (102) models to test the cumulative (dose-response) and life course effects of overlapping forms of childhood maltreatment (113-116). For example, physical abuse is associated with other forms of childhood maltreatment (111), co-occurring with sexual (111) or emotional (112) abuse. Likewise, emotional abuse may occur with other forms of childhood maltreatment (103) including sexual and physical abuse (73). The model suggests the possibility that the consequences of *multitype* forms of childhood maltreatment may be greater than a single form (46, 74, 103, 109, 111, 117).

Both specific (73, 76) and *multitype* (76) classifications appear to have greater predictive validity in relation to developmental outcomes including psychopathology, substance use (72, 76) and RSB (73). However, specific forms of maltreatment, neglect (9, 46) in particular, as well as overall co-occurrence (111) or *general* effects models (77), have rarely been considered in previous studies. There is a need to better understand the complex nature of childhood maltreatment, the underlying risk factors and long-term health impacts (72, 74, 76). However, the predictive validity of multiple forms of maltreatment experiences has not been adequately tested, specifically using substantiated childhood maltreatment in a longitudinal population-based birth cohort study.

There is another measure of childhood maltreatment, referred to as Severity/Frequency. Severity and frequency are based on a Maltreatment Classification System (118), documenting the frequency of childhood maltreatment exposures as a measure of severity (76). The number of maltreatment events can be regarded as an indicator of severity, or possibly even chronicity, in predicting health and behavioural outcomes (49, 119, 120). This seems important given that in Australia 73% of cases receiving CPS are repeat cases (121). It may be more informative to use frequencies of childhood maltreatment incidents to investigate later outcomes either in a specific category (103) or in combined forms (72) of maltreatment. In this study, we investigate the impact of both specific and combined forms of childhood maltreatment substantiations, as well as frequency and age of occurrence, on later outcomes (Chapters 3–7).

Measurements of childhood maltreatment

There are three common research designs used to investigate childhood maltreatment–(1) ratings obtained through child protection workers, (2) searches of protection agency case history files or hospital records (3) and self-report from adolescent/adult victims (104, 122). All of these designs generally rely on the retrospective collection of data on information about childhood maltreatment. Some studies have also used the *occurrence* versus *non-occurrence* dichotomy. Use of this dichotomy allows for the examination of the effect of each form of childhood maltreatment and a consideration of the specific characteristics of subtypes (111). The use of substantiated cases of childhood maltreatment, arguably, strengthens the research design (49). However, the mere use of a dichotomous variable to characterise the experiences of maltreatment, may not adequately address the heterogeneity of childhood maltreatment, its severity and chronicity (104, 123).

Each method has limitations including underestimating the rate of childhood maltreatment, particularly for substantiated cases (51, 104, 124). For example, only 8–11% of sexual abuse (125, 126), 7% of physical abuse or 6% of emotional abuse or neglect (126) may be officially recorded. As a result, the prevalence may vary from 30% in sexual abuse (127), to 75% in physical abuse (128). Official reports of maltreatment are also different from self-reports in terms of sociodemographic characteristics of victims and subsequent outcomes (129, 130). For example, official records of physical abuse have been associated with antisocial and impulsive behaviour, whereas retrospective self-reports of sexual abuse have been found to be associated with depression, anxiety, disruptive and impulsive disorders (129). Moreover, retrospective reports are subject to recall bias (104, 131) and misclassification (11, 74). Although misclassification is a more generic issue not limited or specific to retrospective reports, external validation, particularly using documented cases (104), may minimise some forms of bias (46, 111). However, retrospective reports may also be less susceptible to recall bias, particularly for false negatives (132), since young people may report more childhood maltreatment cases than official records (133, 134).

Other characteristics of childhood maltreatment may be measured as they play a role in later outcomes (119). These include being an offspring of an abused mother, relationship to, and number of perpetrators, use of physical force, and duration, frequency, type and age at the time of maltreatment incidents (69, 86, 135-138). These could be considered to be indicators of the severity of childhood maltreatment (135, 136). For example, early experiences of childhood maltreatment have been reported to lead to such consequences as drug use, suicide (69), symptoms of anxiety and depression (69, 139) and other psychiatric disorders (137). Similarly, persistent maltreatment into adolescence predicts behaviour problems (139) such as violent crime, incarceration, RSB (69), and even intergenerational transmission of childhood maltreatment (138, 140).

There is also a concern with childhood maltreatment that is less severe, perhaps borderline between *maltreatment* and *not maltreatment*, but sharing characteristics with maltreated cases (141). These (*grey)* cases might not be able to be identified using conventional measures, may not appear in official records (104) and remain a challenge for the field (141). The health consequences of *grey* (borderline) cases of childhood maltreatment is not currently known (141). As a result, the World Health Organisation (WHO) and International Society for Prevention of Child Abuse and Neglect suggest there is a need for case identification (98) through uniform methods of definition and assessment (1), as well as comprehensive measurement (i.e., retrospective and prospective) (130). Interestingly, the American Psychiatric Association and WHO have adopted DSM-5 and ICD-11 childhood maltreatment definitions and measurements (101) that may enhance the identification of such *grey* cases through a thorough assessment.

The current study used state-wide child protection records to identify suspected cases of childhood maltreatment. Referrals from community members and mandatory reports from general medical practitioners were the primary sources of information about childhood maltreatment. Queensland government child protection agency workers reports concerning child maltreatment occurrences provide the basis of substantiated cases. These are cases where the then DFYCCQ (now Department of Communities, Child Safety and Disability Services) had "reasonable cause to believe that the child had been, was being, or was likely to be abused or neglected", and were defined as substantiated cases of childhood maltreatment (142). This definition was extended to each form of childhood maltreatment within the umbrella of the common forms of childhood maltreatment. These data were confidentially and anonymously linked to the MUSP longitudinal database (143). In this study, substantiated cases of childhood maltreatment were restricted to those occurring between birth and 14 years of age to ensure childhood maltreatment preceded the assessment of outcomes. Arguably, a combination of both retrospective- and agency-reports of maltreatment is likely to be more useful in detecting cases and capturing subsequent adverse health impacts (130). Prospective evaluation is arguably a methodologically preferred method for detecting cases of childhood maltreatment (130) and examining its consequences (36, 77, 93, 94). Prospective study designs not only have some advantages for the study of childhood maltreatment (2) but they also provide a time frame to measure chronic or recurrent cases of maltreatment.

Magnitude of childhood maltreatment

Globally, a substantial minority of children have been found to experience childhood maltreatment, although prevalence does vary in terms of timing and types, as well as across countries (2, 144) over time. Thus, estimates of the population prevalence of childhood maltreatment range from 12% for sexual abuse to 36.3% for emotional abuse, globally (2), differ

from country to country (2, 144) and even from jurisdiction to jurisdiction within a country (121). In Australian jurisdictions, for example, childhood maltreatment substantiation ranges from 21.5–68.1% among the notified cases (i.e., estimates are from rates in selected groups) in 2015–16 (121). These estimates are however lower than the population prevalence of 12% and 23% (nonpenetrative), and 4% and 12% (penetrative) sexual abuse in Australian males and females respectively (145). Sexual abuse is significantly more commonly experienced by females, while there is little evidence of gender differences in the prevalence of other forms of childhood maltreatment (2, 145). A recent estimate shows that the rate of violence towards children is estimated to be high in the developed world (2, 144), while less is known about its prevalence in developing countries (2). Yet, estimating the actual magnitude of childhood maltreatment has been limited by many factors including the wide variations in the definitions, reporting bias, and social services systems and practices (101, 146). For example, there is a huge difference when childhood maltreatment events involve self-reports versus official records (2, 9, 144). The latter may have significantly underestimated the actual prevalence (2). Moreover, official records are most often *judgements* and limited by lack of specific criteria and *working* definitions (51, 146), as well as perceived fear of people involved in maltreatment notifications due to lack of legal protection on reporting and subsequent disciplinary procedures (147). Although prospectively substantiated incidents of maltreatment may lessen the chance of recall bias (104), ascertainment of cases of maltreatment may also be biased depending on how they have been measured and recorded. Thus, estimates may vary based on different definitions and lack of objective set criteria. Substantiation may also identify specific numbers and forms of childhood maltreatment (130), as the chance of capturing recurrence and predictive validity is typically higher for substantiated cases (148, 149). Moreover, substantiated cases of childhood maltreatment are likely to be more severe (130) and correlate with clinically evident cases (150).

In Australia, there were 355,935 reported notifications and 60,989 substantiated childhood maltreatment cases recorded by the Australian Institute of Health and Welfare in 2015–16 alone; a rate of 8.5 per 1000 total population (121). Of these, substantiated emotional abuse and neglect were the most commonly co-occurring, yet underestimated, forms of maltreatment (121). Over the most recent decade, the number of childhood maltreatment substantiations has been rising in Australia, possibly because of the growing level of awareness through education, media advocacy, etc. among children, parents, community and professionals (police, teachers and healthcare practitioners) (121, 122, 151), as well as changes in laws of childhood maltreatment reporting and identification (152). Interestingly, from a birth cohort of 7214 (excluding 9 children for unavailability of CPS data) children in this study sample, only 10.8% and 7.1% were identified as

notified and substantiated cases of childhood maltreatment, respectively (143). Although Indigenous Australian children are overrepresented for substantiations of childhood maltreatment in the general population (121) and the MUSP (153), these differences could not be assessed because of the small numbers of indigenous respondents participating in this study (154).

Theoretical frameworks

The findings that prenatal and postnatal childhood adversities may have lifelong consequences can be viewed from a number of perspectives. Different theoretical models such as *biopsychological* model (114) and *social learning theory* (155) provide some explanations of the complex interplay of the associations between early life adversities, social and economic disadvantages and later health outcomes. The following subsections briefly discuss each of these theories/mechanisms.

***Biopsychosocial* model and life course epidemiology**

The understanding of mechanisms that link childhood maltreatment to subsequent adverse outcomes is limited and not specifically addressed in this study. This is because of lack of data and/or partly due to the overlap of childhood maltreatment experiences and some early developmental problems. The latter perhaps limits us from testing some pathways or mechanisms on how maltreatment interacts with other early adverse experiences to predict detrimental life course outcomes. Nonetheless, the following literature highlights some ways in which maltreatment is associated with later health impacts. First, the effect of poor psychological development may lead to a range of psychopathologies such as maladjustment (156) and physical health problems (156, 157). For example, emotional problems (88, 158), substance/alcohol use (159, 160), antisocial personality disorder and hostility (160) mediate the association between childhood maltreatment (e.g., sexual abuse and neglect) and PTSD, depression (159), internalising or externalising behaviour (158), delinquency and IPV (160) victimisation (88). Similarly, behavioural under-control may mediate the association between childhood maltreatment including sexual abuse and adolescent binge drinking (161) and substance use in females (162). Moreover, the interaction between childhood maltreatment and PTSD mediates violence (57) and predicts adulthood pain (163) in females (57). Second, childhood maltreatment may affect neurobiology and distort physical, cognitive and socioemotional development (164, 165), leading to adverse life course outcomes (114). That is, behavioural dysregulation (166) with severe PTSD symptom profile (167) may lead to a range of mental and physical health problems (168) in maltreated children. That said, based on *stress sensitisation* and *kindling hypothesis* (169), childhood maltreatment and other recurrent adversities may be responsible for ongoing impacts (170, 171).

From a life course epidemiological perspective on health, childhood life experiences may influence adulthood health through a trajectory of interconnected biological and social processes or factors (172) that may lead to a number of health disorders (172, 173). For example, childhood maltreatment predicts a range of developmental, behavioural and mental health problems (86, 174). As well, its physical health impact is possibly mediated by other adverse life events and psychological distress (157). This study investigates a wide variety of outcomes associated with childhood maltreatment on multiple systems of the victim. We investigate the cumulative impact of childhood maltreatment and the possibility of multiple adulthood adverse outcomes (175, 176). Thus, an *ecological* framework (177-179) that encapsulates the psychosocial and environmental level risk factors may help explain these outcomes within the maltreating milieu. Only a few of prior studies, have considered *ecological* contexts of childhood maltreatment and subsequent adverse outcomes (93), especially limited by lack of control over individual and familial confounders/covariates (77).

The impact of childhood maltreatment from *social learning theory* perspective

From the perspective of *social learning theory* (180), maltreated children may experience behavioural problems in later stages of their lives by imitating their childhood maltreatment experiences. Victimisation involving childhood maltreatment may increase the risk of revictimisation through repetition of early life experiences (19). For example, observation of parental disciplinary patterns (181) and witnessing interparental physical violence (182) may contribute to the association between corporal punishment and psychosocial development (181) and IPV experiences (182). Similarly, childhood maltreatment (183) may lead to poor psychosocial outcomes (184) by increasing the acceptance of violence as a normative characteristic of adulthood relationships (185). That is, childhood maltreatment victims may consider their early adverse experiences as *learned* coercive conflict resolution mechanisms and generalise to their intimate partner relationship (21), including violent sexual experiences (186). There are also instances where functional emotion regulations or development of skills to form meaningful interpersonal relationships may be affected in emotionally abused (187) and neglected (188) children.

Life course outcomes following childhood maltreatment

The following subsections briefly highlight the review concerning childhood maltreatment and selected health outcomes of interest in this study, overall limitations in the literature, and the rationale for the respective studies. Detailed reviews of literature on selected outcomes are presented in Chapters 4–7.

Psychosocial and behavioural impacts of childhood maltreatment

Childhood maltreatment has been associated with a numberof adverse psychosocial outcomes (24, 189-194), with complex symptoms (195) and related economic costs (44) in adulthood. For example, childhood maltreatment (113) including sexual (189, 193), physical and emotional abuse (24, 190, 193, 196), and neglect (24, 103) have been associated with low self-esteem (113) and externalising problems (24, 193) including experiences of violence (192, 194), delinquency (189, 190), crime and incarceration (194). The impacts of childhood maltreatment studied in this category include IPV victimisation, delinquency, RSBs and adverse youth pregnancy outcomes (Chapters 4).

Substance use and mental health disorders

Substance use

A mounting body of evidence from cross-sectional studies suggests that differential (72) and co-occurring multiple forms of childhood maltreatment may be associated with the consumption of, and subsequent dependence on, illicit drugs, and licit and illicit substances (7, 23, 114, 159, 197-205). For instance, sexual or physical abuse is associated with problem drug dependence (7, 23, 159, 197, 199, 200) in both males and females (7, 197, 199). A study has also reported an association between confirmed sexual abuse and regular use of drugs by psychiatric, inpatient, adolescent males and females (206). In females, however, sexual (201) and physical (23, 201) abuse may be differentially associated with lifetime (23) illicit drug use (23, 201, 202). Some of these studies have reported a dose-response relationship (7, 114, 197, 203) suggesting multiple forms of childhood maltreatment may lead to more severe substance use related problems. For instance, a composite scale of sexual, physical and emotional abuse (198), or combined sexual and physical abuse (207) has been associated with cocaine dependence (198) and use of other multiple substances (207) in those who were on treatment for a substance use disorder (198). These studies used self-reports of childhood maltreatment and substance use (7, 197, 203), but did not include emotional abuse and neglect (197).

Some longitudinal studies have reported significant inconsistencies in the association between childhood maltreatment and drug related problems (193, 200, 201). For instance, sexual (201) and physical (200) abuse have not been found to predict substance abuse disorders in males nor females (193, 201). Clearly there are significant uncertainties in the literature. Previous studies have not assessed some forms of childhood maltreatment and disorders associated with use of certain drugs. Injecting drug use (IDU) and cannabis disorders are addressed in this study, and a complete overview on these topics is presented under two subsections of Chapter 5.

Mental health disorders

Evidence from cross-sectional studies suggests that children who are exposed to sexual, physical and emotional abuse and/or neglect are more likely to experience mental health problems than those not exposed (113, 208). For instance, sexually abused children experience higher rates of PTSD (159) and lifetime depression (208). Moreover, people who are sexually and physically abused as children tend to experience higher rates of depression (7, 8, 23), anxiety (7, 23) and suicidal tendencies and attempts (7). Similarly, early exposure to emotional abuse (208) or multiple types of childhood maltreatment (113) are associated with anxiety and depression in adulthood (113, 208). In longitudinal studies, self-reported physical abuse predicts depression and anxiety in middle aged males and females (209); while substantiated cases of neglect, emotional, sexual and physical abuse (24, 193) have been associated with internalising and other mental health problems in adolescents (24) and adults (193).

Although early manifestation of psychotic disorders are more common in maltreated children (e.g., those who have experienced physical abuse and neglect) (137), there are few longitudinal studies that have examined the associations between substantiated childhood maltreatment and psychosis. That is, there is a need for further prospective study (210-214) to examine the effects of specific, *multitype* (8, 113, 210) and multiple incidents of childhood maltreatment, controlling for potential individual, familial and environmental confounders (113, 208, 210). A detailed review of the effect of childhood maltreatment on psychotic experiences and psychosis is presented in Chapters 5.

Physical development and physical health outcomes

Early life stress including childhood maltreatment has the potential to impact on long-term physical development and health (92). These life course impacts may operate through interacting, neurobiological and epigenetic mechanisms (92). For instance, the type and number (215) of childhood maltreatment incidents (216), particularly neglect (41, 48, 217-220), have been associated with smaller head circumference (41, 215, 220), reduced brain size (216, 218) and cognitive deficits (41, 48, 216, 219, 221). Moreover, exposure to childhood maltreatment has been associated with a range of physical health conditions (35, 222) and poor adherence to medications (223). Chapter 6 fully describes the relationship between childhood maltreatment, height deficit, high dietary fat intake, asthma and lung function, as well as poor sleep quality,.

Quality of life

Several cross-sectional studies in clinical and other institutional samples have suggested that childhood sexual (224), physical and emotional abuse (225), neglect and the cumulative score of maltreatment (204, 225, 226) are associated with poor QoL (204, 224, 226, 227). These findings

have been obtained from adolescents boarding in youth care institutions (224), who have comorbid mental health and substance use disorders (204) and generalised anxiety disorders (226), and in a male only sample (227). Notwithstanding these findings, these studies have reported inconsistencies suggesting that sexual (225), physical and emotional (226) abuse, and neglect (225, 227, 228) and their cumulative score (226) was not associated with a poor QoL.

A recent review that involved available cross-sectional studies suggested that all forms of childhood maltreatment have a modest but significant association with poor QoL, pointing to a dose-response relationship (229). It also points to the overrepresentation of a history of sexual abuse in clinical samples. This review further suggests the need for a longitudinal study that uses substantiated cases of childhood maltreatment to test the temporality and directionality of possible associations with QoL (229).

Confounding factors relevant to childhood maltreatment and subsequent outcomes

There are a number of models of child development, each of which suggests the existence of factors, which might confound the association between childhood maltreatment and subsequent outcomes. The *ecological* model summarises risk factors into four interacting systems that function at various levels–at the individual, family, community and society levels (230, 231). This model suggests that children are at risk of childhood maltreatment in different settings (77, 232), and that risk factors associated with these settings may contribute to subsequent outcomes in maltreated children (93, 232). It is arguably difficult to disentangle the impact of childhood maltreatment from other factors which may contribute to both childhood maltreatment and subsequent outcomes.

There may be a variety of pathways (non-mutually exclusive) associated with vulnerability to many outcomes (233). For example, supportive family, school and community environments are associated with better mental health functioning following childhood maltreatment (234). The following sections highlight selected confounders and gender differences in childhood maltreatment and subsequent outcomes. Other factors including parenting styles and parent-child interactions may perhaps be involved in childhood maltreatment (235) but are excluded from this review (236).

Child-related confounders

Sociodemographics, birth outcomes and early ill-health

There are a wide range of child-related sociodemographic factors that may be associated with childhood maltreatment (9, 78, 80, 237) and later health outcomes (82). These include race (237, 238), gender (9, 83, 237, 239) and academic achievement (237, 240). That is, the likelihood of childhood maltreatment is high in adolescents with low school performance (81). Birth outcomes such as an unintended pregnancy (80), prematurity (78, 79), low birth weight (LBW) (78-80) and poor health during childhood (80) (e.g., frequent illnesses (80)) are also associated with higher rates

of childhood maltreatment. For example, prematurity related disease susceptibility may increase demand for care, which may in turn, increase stress on caregiver (241) and/or may decrease bonding (242, 243), which are risk factors for childhood maltreatment (241-243).

Outcomes tend to differ based on differences in racial origin and gender (244). Males are inclined to experience more antisocial personality disorders (ASPDs) (244) whereas females experience more anxiety and depression disorders (245). Some of these outcomes are more prevalent in Whites than other races (e.g., Blacks) (244). This may be due to high PTSD rates in Whites than other racial groups (246). Similarly, low educational level (247) and underlying low socioeconomic status (SES) may predict psychological outcomes (82) and higher levels of mortality (247). Early problems including medical history and social services intake in children are also associated with higher rates of substantiation (238) of childhood maltreatment and related hospital admission (248).

Childhood and adolescent developmental problems

Childhood maltreatment (9) has been associated with developmental delay (78), developmental problems (behavioural and general development) in infancy (80), internalising (81, 249, 250) and externalising problems (249, 250), as well as poor cognitive outcomes (93) (e.g., speech (80)), lesser social skills (249), addictive behaviours (251), disability (252) and other physical health problems (36, 56) in adolescents (17, 81, 253). Inconsistent and neglectful parenting is also associated with poor emotional control (17), aggression (53, 254) and attention deficit/hyperactivity disorder (ADHD) (255). Children with these latter behavioural patterns may be subjected to parenting practices intended to respond to these behaviours (256), and might consequently be at higher risk of substantiated maltreatment (238) and associated adverse outcomes (257-259).

Parental confounders

Sociodemographic characteristics

A number of parental sociodemographic characteristics have been found to be associated with childhood maltreatment and to predict a range of offspring psychosocial and health outcomes (81, 260-262). For instance, higher rates of substantiated (124) childhood maltreatment have been associated with a variety of indicators of parental socioeconomic hardships (93). These include nonwhite parents (83), low familial (239, 263) and maternal (83) education, unemployment (93, 236, 249), low income (81, 83, 249) and poverty (236), as well as maternal young age (81, 249) and early parenthood (81). The likelihood of childhood maltreatment is higher in unfavourable living conditions (239) and home environments such as single parenthood (124, 249), absence of the mother (83), father's rejection (264), chronic (265) family instability (81, 93), family conflict (81,

249) and domestic violence (DV) (262). The risk of childhood maltreatment is also associated with maternal poor social support (249, 266) (e.g., paternal low social support (267)), familial experiences of more negative life events (NLEs) (81) including prior childhood maltreatment (86, 268), cultural norms supporting corporal punishment (250) and criminal behaviours (249). *Polyvictimisation* associated with childhood maltreatment is more likely in a dysfunctional family (74) and some of these factors contribute to more childhood maltreatment substantiations (236, 268, 269). As well, these factors may contribute to continued poor parent-child attachment (81) and low quality child care (270). Parental stress through impoverishment, for example, may lead to neglect or suboptimal parenting, in turn, leading to child stress and subsequent stress reactions resulting in long-term behavioural and cognitive dysfunction (271).

The following factors also predict poor health outcomes in offspring (260, 261). For example, offspring born to mothers younger than age 25 or older than 35 years (260) and who lack social support during pregnancy (261) are at risk of worse outcomes including LBW, height deficit (260, 261), obesity, higher rates of diagnosable health problems and mortality than those born to mothers aged 25–34 (260) or who have adequate social support (261). Similarly, race and childhood adversities (e.g., neglect) interact and are associated with adverse health habits such as cigarette smoking (272, 273). Low family SES predicts negative psychological experiences such as hostility and discrimination (82). Children who experienced family breakdown including DV (262) and divorce (274-276) are characterised by lower educational attainment, problems of social interaction and relationships, early sexual intercourse, cigarette smoking, alcohol consumption, antisocial behaviours, PTSD, cognitive deficits, poor mental health (anxiety, depression, internalising and externalising), suicidal thoughts and poor overall wellbeing (274-278). Similarly, maternal exposure to childhood physical abuse (272) and low social support (261) are associated with adverse pregnancy outcomes (e.g., smaller body length and LBW (261)) and increased risks of childhood smoking (272). Moreover, criminal behaviour tends to be intergenerational (279), where children from criminal first-degree relatives tend to be more violent criminals than if criminality is associated with that of a more distant relative (280).

The effect of poor family functioning on poor interpersonal relationships may be due to a particular attitude, conflict with partner, lack of commitment to their relationships (278) and social support (281). The effect of family conflict or disruption on children's health may also be through its effect on *biopsychosocial* mechanisms (282). For example, maternal antenatal NLEs including death of a relative are associated with offspring schizophrenia (283). That is, conflict, aggression, unsupportive and neglectful relationships within families may predispose children to vulnerabilities and/or interact with their genetically based vulnerabilities. This may lead to disruptions in emotion

processing and social competence, dysregulation of stress-response systems and poor health behaviours (284). These factors, in turn, might lead to poor mental health, major chronic diseases and premature mortality (284). This is not to deny that much of the relevant evidence is somewhat speculative but to note that many causal pathways have been proposed. Furthermore, social support partially mediates the relationship between childhood maltreatment and *allostatic load* (63). Inversely, a child reared in an environment with higher social support, higher optimism, better health and healthy relationships, happiness, less difficulty balancing work and family responsibilities in a family with fewer maternal mental health problems is less likely to experience developmental problems (285) and poorer QoL (108). Familial structural adjustment, emotional and social support are protective for offspring smoking (253) and poor QoL (108), and the effect is fully mediated by adolescent family support/stability, social adjustment and better school performance (286).

Parental psychopathologies and substance use

Childhood maltreatment often coexists with other household adversities (105, 106). Children growing up within the context of parental psychosocial disadvantages (93, 249), poor mental health especially maternal mental health problems (83), maternal and paternal (287) depression (16, 249), maternal anxiety (239) and stress (249) are found to be at greater risk of childhood maltreatment. Interestingly, maternal depression during pregnancy and the postpartum period is associated with difficulties in early childhood perceptual performance, behavioural difficulties (288), internalising and externalising problems (289). Similarly, the risk of substantiated childhood maltreatment (269) is higher in families with substance use (290) such as maternal (83) smoking (83, 239) and, maternal (264) and paternal (291) alcohol consumption (81, 249). Psychopathology, such as depression, may influence the ways parents respond to the needs of children (292) and subsequent care (270). Similarly, alcoholic (293, 294) and offending (295) parents may provide less attention (270, 293), poor hygiene and supervision (296), as well as harsh discipline (295) and parent-child relationship (293), with continued likelihood of childhood maltreatment (294). Again here it needs to be acknowledged that the relevant causal pathways may be complex and poorly understood.

Higher levels of childhood maternal distress predict offspring anxiety, depression and lower self-efficacy (297). Household alcohol abuse (272, 275), or prenatal exposure to either maternal cigarette smoking, alcohol or cannabis use have been related to symptoms of offspring ADHD (e.g., inattention and impulsiveness), decreased general cognitive ability, deficits in learning and memory (298). These parental dysfunctions also increase the risk of externalising behaviour (298), ASPD (e.g., behavioural problems and criminal involvement) (299), later cigarette smoking (272, 275,

300), alcohol use, cannabis use, and substance use related crime (272, 300) and psychotic symptoms (301). Maternal prenatal alcohol use also mediates the association between sexual abuse and preterm delivery (302). One study has suggested that maternal prenatal depression predicts elevated offspring risk of cardiovascular disease at age 25, independent of childhood maltreatment, adulthood depression, and other risk factors for adulthood inflammation (303). Children exposed to both maternal antenatal depression and childhood maltreatment may be at greater risk of psychopathology than offspring exposed to neither (304). Overall household dysfunction is associated with a range of outcomes (106) including fewer years of education, PTSD, depression/anxiety and externalising behaviours (68, 305). Overall, familial socioeconomic disadvantages, poor mental health and substance use (107, 236) are common risk factors for childhood maltreatment (306, 307) substantiation (238), *polyvictimisation* and subsequent severe mental health (107) and multi-system (308) disorders.

Child supervision and breastfeeding

Childhood maltreatment is common in settings characterised by poor (81) child-parent relationship (249) including low attachment to a child (81), inappropriate type (e.g., authoritarian) of supervision (93)), suggesting lower level of commitment to the child. Harsh parenting styles (309) and dysfunctional parenting including maternal or paternal rejection are associated with both childhood maltreatment (241) and child mental health problems (309), even after controlling for childhood abuse, gender and race (310). The rate of childhood maltreatment is high in children who have not been breastfed (143) and breastfeeding for more than 6 months is associated with improved motor development outcomes in all children (311).

Environmental confounders/mediators

Childhood maltreatment is associated with environmental disadvantages including less social cohesion (312-314), gang peer membership (81), growing up in urban area (315), neighbourhood drug use (81, 312) and community violence (316). Neighbourhood disadvantage such as poor housing or poor living conditions (124), overcrowding (266) and lower neighbourhood SES (82) are also associated with higher rates of high body mass index (BMI) and lower basal cortisol levels, hostility, discrimination (82) and functional impairment (124), as well as the effect of childhood maltreatment on drug use as a consequence of these poor neighbourhood conditions (312). Furthermore, exposure to community violence is linked with scholastic and cognitive difficulties, posttraumatic stress symptoms, depression and aggression (281). The effect is more pronounced in maltreated children who live in high crime neighbourhoods (317) with poor social networks (314). There is some evidence that maltreated children who live in low social cohesion areas are also less likely to be resilient to later adverse outcomes (317).

Gender differences in outcomes of maltreated children

There is a substantial gender difference in both experiencing childhood maltreatment and responding to its consequences. The overall prevalence of childhood maltreatment may be greater in males than in females (e.g., 40% in males versus 30% in females) (237), although there are some reports in which females are at greater risk (39). Males tend to report more childhood physical abuse than females (245, 315, 318), whereas females experience more CSA than males (127, 315) including substantiated sexual abuse (319). This difference may be due to bias as sexual abuse is commonly expected to occur more frequently in females (320). Females are at greater risk of multiple forms of childhood maltreatment (72, 73). Consistently, in Australia, females (16%) are more likely substantiated for sexual abuse compared to males (9%), although males are characteristically at higher risk of substantiation for other types of maltreatment (121). However, there may be no gender differences in exposure (275) to multiple forms of childhood maltreatment and later outcomes(72).

Males and females may respond differently to the effects of childhood maltreatment because of the interaction of biological and psychological factors coupled with the severity of these factors (321). For example, sexual (275, 322), physical (245) and emotional (275) abuse has been found to predict cigarette smoking (275, 322), mental and physical health problems (245) in females but not males. Gender has been found to interact with adverse exposures including childhood maltreatment to impact on educational attainment and criminal activity, especially for males (68). Arguably there may be gender-specific genetic predispositions. For example, males with a short variant (323) and females with one or two long variant monoamine oxidase A polymorphisms (323, 324) have been found to have a higher risk for delinquency (323) and criminal behavior (324) as a result of exposure to childhood maltreatment (323) and other psychosocial risks (324).

The mechanisms of these associations might also differ according to gender. That said, PTSD may mediate the association between childhood maltreatment and dating violence, in females but not males (57). Drug use symptoms in maltreated young adult females may be more affected by neighbourhood circumstances in males (312). Likewise, childhood maltreatment (244) including physical abuse (325) is associated with PTSD (326) and externalising (325) such as IPV perpetration (327), crime (328) and antisocial behaviour in males (244) and through youth violence (327), but internalising (325) and affiliation with antisocial peers (328) in females. Gender difference may also work in different ways for different outcomes in victims of childhood maltreatment (22). That is, internalising symptoms and substance use problems are mediated by age at the onset of sexual involvement in females whereas involvement in criminal behaviours is mediated by age at first criminal arrest in males (22). The effect of childhood maltreatment may

also vary by the age at which the maltreatment occurred, with females experiencing early physical abuse exhibiting more PTSD (329) and substance use symptoms (330). Females with substantiated sexual abuse may be more likely to visit a physician for physical health problems, while males with the same exposure have been found to more often visit for mental health problems (331). Thus, analyses should consider these gender differences either by undertaking analyses separately for both or including gender-childhood maltreatment interaction term, in addition to the main effect of gender.

Overall objective, specific aims and objectives of the current study

Overall objective

The overall objective of the thesis is to investigate the magnitude and direction of the health impacts of substantiated childhood maltreatment on a number of negative life course outcomes including lifetime poor psychosocial functioning, RSBs, substance use disorders, mental and physical health, and related poorer QoL, after adjusting for confounders and/or covariates at different levels of the children's ecology. We also examine the indepedent and compounded effects of different and multiple forms and/or recurrent incidents of childhood maltreatment on later health outcomes.

Aims and objectives

The overall aim of this thesis is to investigate life course health outcomes following exposure to substantiated childhood maltreatment (ages 0–14 years). There are four aims and twelve objectives corresponding to each chapter and paper included in the Results section.

Aim 1: To examine the psychosocial effects, RSBs and pregnancy outcomes of childhood maltreatment in young adulthood

Objective 1.1: To examine the association between childhood maltreatment and IPV victimisation.

Objective 1.2: To investigate the gender differences in delinquency following childhood maltreatment.

Objective 1.3: To review the association between CSA and the cumulative risk of RSBs.

Objective 1.4: To determine the risks of an early age of sexual debut and multiple sexual partners (MSPs) in both genders, and the risk of young pregnancy, termination and miscarriage of pregnancy following childhood maltreatment in females.

Aim 2: To investigate the association between childhood maltreatment and substance use and mental health disorders.

Objective 2.1: To examine whether gender-specific differences exist in IDU among the maltreated children.

Objective 2.2: To determine the association between childhood maltreatment and cannabis use

disorders and age of onset of these disorders.

Objective 2.3: To examine the association between childhood maltreatment and delusion, hallucination and psychosis experiences.

Aim 3: To explore the physical development and physical health effects of childhood maltreatment

Objective 3.1: To determine the association between childhood maltreatment and young adult height.

Objective 3.2: To explore young adulthood dietary fat intake pattern among the maltreated children.

Objective 3.3: To determine the association between childhood maltreatment and asthma and lung function in young adulthood.

Objective 3.4: To examine the association between childhood maltreatment and sleep quality.

Aim 4: To assess the overall QoL of young adults who were maltreated in childhood

Objective 4.1: To assess the association between childhood maltreatment and QoL.

Chapter 3 – Methods and Measurements

Study design and sample of the Mater-University of Queensland Study of Pregnancy

The MUSP is a pre-birth, prospective, Australian study that initially recruited public patient pregnant women to participate in a study. The study consecutively recruited women attending their FCV at the Brisbane Metropolitan MMMH from January 1981–83, Queensland, Australia. The mean gestational age at recruitment was 19.7 (standard deviation (SD) ± 6.1) weeks. Public patient deliveries in the hospital accounted for 54.6–61.3% of total deliveries within this time frame, contributing to 6000–7000 deliveries each year (332). It excluded all emergency transfers or referrals from other hospitals (154), private patients, those patients in need of intensive neonatal care, babies who died at delivery or post-delivery, as well as those transferred to other hospitals (332). Of the total 8556 pregnant women who were invited into the study, 8458 (98.9%) pregnant women consented to participate in the study, and 7631 (32.6% primigravidae) mothers gave birth to a live singleton baby at the hospital. A total of 7223 live, singleton babies, who were not adopted out prior to leaving the hospital make up the study cohort. Of these, 520 children pairs were siblings born from the same mother at different times within the study period (154).

The MUSP sample was relatively young (*Mean* age = 25, SD ± 5.11, 75% interquartile range = 21.1–28.3 years); also of lower and middle SES as characterised by lower reported family income (< $26,000/year) (34.2%). Racial distribution was generally Caucasians (91.8%) followed by Asians (3.7%), Indigenous Australians (2.3%), Maori and Islanders (1.8%) and 0.7 with mixed racial backgrounds (332). However, the cohort did not differ from private clients in terms of other sociodemographic characteristics and birth outcomes including gestation, birth weight, intensive care unit admission and perinatal mortality (332). Birth outcomes were obtained from medical records of the pregnancy and birth. In terms of lifestyles in early pregnancy, women reported their cigarette smoking over past week and cannabis use for last three months of the pregnancy. An approximation of standard alcohol drinks per day was also reported. Some 40.1%, 49.6% and 3.1% women reported any cigarette smoking, alcohol and cannabis use, respectively (332).

The study initially collected biological, sociological and psychological data that were believed to be potentially relevant to birth outcomes. Mother-child dyads were then assessed at 3–5 days postpartum and mothers were followed up again when the child was 6 months, 5, 14 and 21 years of age. In earlier follow-ups up to the 14-year follow-up, medical or obstetric records were used, as well as mothers reported health and behavioural data pertaining to themselves and their children (154, 332). When the offspring were 21 years old (i.e., in 2002–04), they were invited to participate in an interview which comprised a wide range of measures of health and wellbeing. Over 2000 items were used to collect data including sociodemographic characteristics, lifestyle, mental

and physical health, as well as anthropometry, lung function and QoL (154). The following subsections present summaries relevant to this study.

The current study

Data for the current study were taken from two sources–the MUSP and government DFYCCQ. Government data from the DFYCCQ was the source for substantiated childhood maltreatment variable. Ascertained data on childhood maltreatment from birth to 14 years of age was linked to the MUSP dataset obtained at the 14- and 21-year follow-ups (see details below).

All variables pertaining to outcomes and confounders were taken from the MUSP mother-child dyads up to 14-year follow-ups. Measures of offspring covariates and outcomes were obtained at the 21-year follow-up. Maternal and child related confounder and/or covariate variables included in this study, from each follow-up, are presented in Appendix 4 (Tables 6–7). All study participants were included, and various outcome measures were obtained prospectively at the 21-year follow-up in 2002–04 (154). These included 1980–3818 participants with a mean age of 20.6 years (*Range*: 19–22 years) to analyse different outcomes. These details are described in Appendix 1 (Figure 1).

Measures of substantiated childhood maltreatment

There is a policy of mandatory reporting of suspected childhood maltreatment cases to the government DFYCCQ by medical practitioners and the general public. The notifications of childhood maltreatment are screened by the department and substantiated when confirmed for "reasonable cause to believe that the child had been, was being, or was likely to be abused or neglected." Substantiated sexual abuse was defined by the department when confirmed for "exposing a child to, or involving a child in, inappropriate sexual activities." Physical abuse involved "any nonaccidental physical injury inflicted by a person who had care of the child." Emotional abuse was defined as "any act resulting in a child experiencing any kind of emotional deprivation or trauma." Finally, substantiated neglect encompasses a "failure to provide conditions that are essential for the healthy physical and emotional development of a child", incorporating both dimensions of physical and emotional neglect (142). These were assessed based on definitions from the government Service Provision Review (142). Childhood maltreatment was dichotomised as *no/yes* and coded as *not maltreatment* versus *any substantiated maltreatment*, if confirmed for abuse and/or neglect. Further, children were labelled for substantiated cases of sexual, physical and emotional abuse, and neglect. Age at, and frequency of, substantiations were also recorded. *Unsubstantiated cases* were assigned if notifications were not confirmed for the occurrence and/or significant risk of maltreatment.

Dr Lane Strathearn initially obtained access to state-wide child protection agency records of suspected and obtained details of substantiated cases of childhood maltreatment up to the age of 16

years (41). Both notified and substantiated childhood maltreatment data were anonymously linked to the MUSP dataset (143). Data for 9 children were not found by the department, 7214 children cohort remaining available for the data linkage (143). These include notified cases but which were not able to be investigated for various reasons including interstate movement of families. Based on the government DFYCCQ reported definitions, 11% (n = 789) and 7.1% (n = 511) participants experienced any notified and substantiated childhood maltreatment cases, respectively (143). The records also had details of age at, and the number of, childhood maltreatment notifications and substantiations. A total of 3.3% (n = 239) and 5.3% (n = 381) children respectively were substantiated as maltreated before and after age 5. Similarly, 1.5% (n = 106) and 1% (n = 65) children experienced one, and two or more incidents of substantiated maltreatment, respectively. Linkage to these records was extended to the MUSP dataset, up to the 21-year follow-up. Distributions of subtypes of substantiated childhood maltreatment by gender are presented in Appendix 2 (Table 2). For more details, see *Methods* section of each paper.

This study has used substantiated cases of childhood maltreatment, restricted to those confirmed cases between 0–14 years of age. Up to 2.4% (n = 176) of any substantiated maltreatment, 0.7% (n = 53) sexual abuse, 0.8% (n = 60) physical abuse, 1% (n = 71) emotional abuse and 1.2% (n = 89) neglect cases were included in this study. This study has also investigated the effect of age at, and frequency of, childhood maltreatment substantiations on later outcomes. There were also instances where we used unsubstantiated childhood maltreatment records in sensitivity analyses to supplement the findings for substantiated cases.

Specific categories (76) and co-occurring (102) forms of childhood maltreatment included substantiated sexual abuse, physical abuse, emotional abuse and neglect, as well as one or more combinations of the preceding childhood maltreatment types. This classification appears to have greater predictive validity in relation to developmental outcomes of childhood maltreatment (76, 102). To disentangle the specific effects of each form of childhood maltreatment, a composite variable was created. For example, a variable that excluded substantiated sexual abuse was created from one or more combinations of physical abuse, emotional abuse and neglect to adjust for sexual abuse and so on. Each composite variable was used to adjust for a specific model that examined the association between each subtype of childhood maltreatment and specific outcomes. Moreover, various combinations of the different forms of maltreatment, based on literature, were used in different papers (Chapters 4–7).

In this cohort, teenage motherhood, maternal lower educational status, NLEs, criminal history and marital instability, as well as violence at home and family poverty were associated with higher rates of substantiated childhood maltreatment. The rate of substantiated maltreatment was

also higher in maternal stress and perinatal cigarette smoking. Moreover, adverse childhood outcomes including prematurity, LBW and never breastfed were associated with an increased likelihood of substantiated childhood maltreatment. Aggression and internalising problems in adolescence, and alcohol use and depression in young adulthood, were associated with substantiated maltreatment. Finally, those young adults who were never married/divorced, had lower education, received social security scheme and lived in residential problem areas experienced higher rates of substantiated childhood maltreatment.

Outcome measures at the 21-year follow-up

The following subsection (Table 1) highlights offspring outcome measures at the 21-year follow-up. Selected measures are limited by what is available in the MUSP. In addition, this study focuses on topics that were not addressed by other MUSP investigators. A more detailed description of variable measurements and validations were presented in respective paper, accordingly, and in Appendix 3 for selected outcomes.

Table 1. List of outcomes and their measurements.

Outcomes investigated	Measurements
IPV victimisation	Composite Abuse Scale (CAS) and subscales (333-335)
Delinquency	Achenbach's Young Adult Self-Report (YASR) Behaviour Checklist (336, 337)
RSBs and pregnancy outcomes	Meta-analysis and RSBs inventory
Substance use and abuse	Injecting illicit drug and cannabis use inventory
	Cannabis use disorders – WHO Composite International Diagnostic Interview (CIDI-Auto) (338-344)
Mental health	Hallucinations – Achenbach's YASR Behaviour Checklist (345, 346)
	Delusions – Peter's Delusions Inventory (PDI) (347-349)
	Psychosis – and WHO CIDI-Auto (338, 339, 350, 351)
Physical health	Height – Standardised height-for-age *z*-score stadiometre (to the nearest cm)
	Fat intake – Short Fat Questionnaire (SFQ) (352-354)

	Sleep quality – Pittsburgh Sleep Quality Index (PSQI) (355, 356) Asthma – self-report of physician diagnosed asthma (357, 358) and lung function –Spirobank G spirometre (359-361)
Quality of life	Self-report on overall satisfaction and happiness (224, 362-364), and selected items from Achenbach's YASR Behaviour Checklist (345)

Measures of confounders/covariates

Confounders

Both maternal/familial and child related confounders were included in this study based on literature, theory or bivariate analyses. These variables differ from paper to paper, based on the research question addressed in a particular paper. These broadly included maternal/familial sociodemographic characteristics (365), NLEs (366), social network (367), criminal offences, marital instability, violence at home (368), mental health and lifestyle (369, 370), as well as parental parenting experiences including breastfeeding and supervision. Moreover, child sociodemographics such as gender was recorded at birth, and used to adjusted or test for gender differences, as well as to calculate the interaction term with childhood maltreatment experiences. Other child-related variables included birth outcomes, ill-health, early childhood ADHD (371), adolescent aggressive behaviour (371), internalising problems (371) and smoking. All selected potential confounding variables are presented in Appendix 4 (Table 6) by substantiated childhood maltreatment.

Covariates

The study also included young adult measurements treated as covariates at the 21-year follow-up. These are concurrent measures with the outcome variables, and as such, these variables are not considered to have confounded the prediction of childhood maltreatment. These covariates consisted of educational level, income, marital status, residential problem area, cigarette smoking, alcohol use, internalising problems (336) and depressive symptoms (372), as well as physical activity (373) and BMI. The detailed description of these variables is presented in respective papers and Appendix 4 (Table 7)

Statistical modelling and analyses

This section briefly describes the statistical modelling approaches used in this study. A detailed description, with total sample size included and attrition management have been indicated in each paper (Chapters 4–7).

Descriptive statistics

The Pearson's chi-square statistics was used to determine group differences (374) in relation to baseline characteristics, childhood maltreatment and respective binary outcomes. Moreover, analysis of variance was used to compare mean values of continuous variables (375), as well as to examine the bivariate associations between childhood maltreatment and these variables.

Logistic regression

Both unadjusted and multivariable logistic regression analyses were carried out for categorical variables (376) to determine the independent effect (377) of childhood maltreatment on respective outcomes ($Y_{(0 = \text{negative},\ 1 = \text{positive})}$). The outcome variables were presumed to have a binomial distribution, are independent observations, are non-multicollinear and non-linear (376). The equation in our analyses took the following form:

$$\log (\text{odds } Y = 1) = \alpha + \beta_1 CM + \beta_1 X_1 + \beta_2 X_2 + \beta_k X_k + e \qquad (1)$$

where, log (odds Y = 1) = OR for maltreated,

α = odds of outcomes for nonmaltreated and those without exposures on the X's or confounders/covariates,

β coefficients = odds of outcomes for maltreated and those with exposures on the X's (i.e., confounders/covariates),

CM = childhood maltreatment.

An extended logistic regression, multinomial logistic regression, was also used to measure the association between nominal dependent variable and multinomial distribution being conditional on independent variable with the following equation:

$$\frac{\log\ (\text{odds } Y = j)}{(\text{odds } Y = j')} = \alpha_i + \beta_j CM + \beta_j X_1 + \beta_j X_2 + \beta_j X_k + e \qquad (2)$$

where, j = 1, ...k.

This measure was used to assess the odds of an outcome relative to the reference category (j′), a criterion that makes this model different from the logistic regression. In the current study, this model was used to assess cannabis use disorders with three categories.

The maximum likelihood ratio was used to test for model fit and a Wald test for significance. In multivariable and multinomial logistic regression models, relevant variables were entered either at one stage or stepwise based on preliminary findings and literature. Both unadjusted and adjusted odds ratios (ORs) with 95% confidence intervals (CIs) were used to report our findings. Qualitative descriptors of the effect size for the ORs (378) were used to assess the magnitude and strength of the association.

Linear regression

Both unadjusted and multivariable linear regression models were undertaken for continuous variables (377). The assumptions of independence, linearity, homoscedasticity and normality (377) were assessed and transformation was considered for any deviation (if indicated). In multivariable linear regression models, relevant variables were entered either at one stage or stepwise, and T-test was used to test for model fit.

$$Y = \alpha + \beta_1 CM + \beta_1 X_1 + \beta_2 X_2 + \beta_k X_k + e \qquad (3)$$

where, α = coefficient of intercept for predicted Y for nonmaltreated and those without exposures on the X's or confounders/covariates,

β coefficients = magnitude of change in Y for a single unit change in childhood maltreatment and on the X's or confounders/covariates and *e* is a random variable representing the difference between observed and predicted values of Y.

Interaction term

We also tested the effect of gender and any childhood maltreatment interaction term (376, 379) on selected outcomes, whereby initial preliminary analyses showed significant gender differences. For the remaining outcomes, gender was considered either as a confounder or analyses were done for either gender separately.

$$\log(\text{odds } Y = 1) = \alpha + \beta_{1CM} + \beta_1 X_1 + \beta_2 X_2 + \beta_3(\text{GenderXCM}) + \beta_k X_k + e \quad (4, \text{binary outcomes})$$

$$Y = \alpha + \beta_{1CM} + \beta_1 X_1 + \beta_2 X_2 + \beta_3(\text{GenderXCM}) + \beta_k X_k + e \quad (5, \text{continuous outcomes})$$

where, β_3 = interaction term (multiplicative effect) of gender and any childhood maltreatment, testing the effect of childhood maltreatment and confounders/covariates on Y, in addition to the main effects of gender as a confounder, and childhood maltreatment.

Stepwise and forward selection of variables

In the first, confounder/covariate variables were entered into the model on the basis of being associated with the independent and/or dependent variables on literature, theoretically, or bivariate analyses. Stepwise selection was then used whereby the effects were entered and removed from the model forwardly or backwardly until no further effect was added (380). Furthermore, a forward stepwise model was conducted in which variables were entered according to their association with each outcome until no more reached statistical significance (380). Only variables significantly associated with the outcome were included in the final run of the respective models. This technique minimises the chance of the likely loss of statistical power.

Fixed- and random-effects models for meta-analysis

Both random- and fixed-effects models were used to estimate the pooled OR of the extracted ORs for the association between sexual abuse and RSBs. Random-effects model assumes individual effects are uncorrelated with independent variable (381) and accounts for any heterogeneity in the estimates across the included studies (382), while fixed-effects model assumes individual effects are correlated with independent variable (381). See meta-analysis paper (Chapter 4) for more details.

Missing data and its management

Overall, mothers who were young, single and with lower income had higher rates of attrition. In other words, children with LBW, whose mothers were more likely to be in their teens, had incomplete high school, were single, were smokers and had poorer mental health at FCV were more likely to be lost to follow-up (154). Interestingly, attrition has not affected the birth (332) and later outcomes (383) in the MUSP cohort in general nor biased the findings of this study. Indeed, the rate of attrition was low in the first five years of the follow-ups, although there was a significant level of attrition in the later follow-ups (154, 332, 383). As a result, the current study used inverse probability weighting (IPW) analyses to address attrition in each paper resulting from this study.

A listwise deletion was used to conduct the analyses, excluding those participants with missing data at the 21-year interview. Although attrition has not affected the MUSP outcomes overall (154), weighted analyses using IPW (384) from the complete cases (385) were done to determine whether missing values affected the findings. We preferred IPW because the MUSP cohort has different patterns and predictors of missing values, and the application of a technique that adjusts for missing values (e.g., IPW) has been recommended (386). That said, several variables were correlated with missing values, suggesting that data were not missing at random. Moreover, a substantial amount of data pertaining to childhood maltreatment were missing for each variable of interest, and weighting by using all available data is a preferable method instead of imputation (384). The details of these analyses are detailed in *Methods* section of each paper, and where appropriate presented as supplementary material. Statistical analyses were done using STATA (StataCorp LP: College Station, Texas, 2015) and SPSS (IBM Corp: Armonk, NY, 2013) for windows. Statistical significance level was set at *p*-value of 0.05 for a two-sided test.

Chapter Four – Psychosocial and Behavioural Impacts of Childhood Maltreatment

Childhood maltreatment and IPV victimisation

Published manuscript (click here to access full length article) and cited as:

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Objective: The study examined the effects of types of childhood maltreatment on different forms of IPV victimisation.

Abstract

Little is known about the associations between various types of childhood maltreatment and multiple forms of IPV victimisation in early adulthood. This study examines the extent to which childhood experiences of maltreatment increase the risk for IPV victimisation in early adulthood. Data for the present study are from 3322 young adults (55% female) of the MUSP with the mean age of 20.6 years. The MUSP is a prospective Australian pre-birth cohort study of mothers consecutively recruited during their FCV at Brisbane's Mater hospital from 1981 through to 1983. Child protection agency recorded substantiated cases of child maltreatment dataset was linked to self-reported CAS at the 21-year follow-up. In adjusted models, the odds of reporting emotional IPV victimisation were 1.84, 2.64 and 3.19 times higher in physically abused, neglected and emotionally abused children, respectively. Similarly, the odds of physical IPV victimisation were 1.76, 2.31, 2.74 and 2.76 times higher in those children who had experienced physical abuse, sexual abuse, neglect and emotional abuse, respectively. Harassment was 1.63 times higher in emotionally abused children. The odds of severe combined abuse were 3.97 and 4.62 times greater for emotionally abused and neglected children, respectively. The strongest associations involved reports of child emotional abuse and neglect and multiple forms of IPV victimisationin young adulthood. Childhood maltreatment is a chronic adversity that is associated with specific and multiple forms of IPV victimisation in adulthood.

Keywords: substantiated childhood maltreatment, intimate partner violence victimisation, birth cohort study

Introduction

Intimate partner violence (1) victimisation has been associated with a number of adverse health consequences. A number of lifetime, chronic exposures (2) such as witnessing DV (3), childhood maltreatment including sexual, physical and psychological abuse, and neglect (4) may lead to victimisation (5) to multiple forms of IPV (6). These consequences include sexual (7), physical (8) and psychological (5) violence, and neglect (6) into adulthood. Despite these consequences, little is known about the effects of different forms of child maltreatment, particularly emotional abuse and neglect, on IPV victimisation especially in early adulthood. One area in which there has been less information is the link between an early life course history of child maltreatment and subsequent IPV victimisation, although a handful of cross-sectional studies suggest there may bean association(9). Experiencing child sexual abuse, for instance, is associated with a twofold greater likelihood of subsequent lifetime IPV overall, while childhood physical and sexual abuse together have been associated with a sevenfold increased risk of lifetime physical and sexual IPV (10). Similarly, another study reported a greater tendency for lifetime physical and sexual violence (9) and later IPV victimisation (11) in males and females who had experienced childhood maltreatment.

These cross-sectional findings are confirmed by longitudinal studies (2, 6). Those exposed to early experiences of physical and sexual assault or abuse, kidnapping or stalking, and having a family or friend murdered or who committed suicide are likely to report later IPV victimisation. Physical abuse (12), sexual abuse, neglect (6) and overall child maltreatment (2) are associated with high risk of later sexual violence (13) and lifetime IPV victimisation (14). In one study, the impact of child physical abuse on IPV victimisation in females (15) was mediated by the quality of the relationship, as measured by the strength of attachment to one's partner. Further, findings from the literature (16) and systematic (12) reviews have suggested that female sexual abuse survivors may experience more relationship problems and sexual dysfunction that may possibly lead to subsequent IPV victimisation.

Children who have been maltreated experience a range of mental health problems (17) which, in turn, may lead to being a victim or perpetrator (or both) of IPV. For instance, findings from high school and child protection services samples (18) show that PTSD may increase withdrawal from normal interactions possibly leading to hypervigilance (19) that might increase the tendency for the perpetration of IPV. Moreover, exposure to child maltreatment may lead to mental illnesses (20) including depression (21), anxiety and dissociation (18), and being a subsequent victim ofIPV (18) particularly for those *polyvictimised*in childhood (22) and admitted for drug treatment (23). Early onset aggressive behaviour (15) and alcohol (24) may also be associated with

both exposure to child maltreatment and later involvement in IPV experiences. There is, however, a possibility that parental social disadvantage including family violence and instability (25) chronic maternal stress and NLEs (8) may confound early adversity and later IPVexperiences and other adverse outcomes.

Though the mechanisms remain a matter of debate, IPV victimisation in adults tends to be greater among those who have been maltreated during their childhood (26). A number of potential mechanisms may account for this association. Socioeconomic disadvantage including poverty, family instability and conflict, maternal poor mental health, early problem behaviours in children and neighbourhood poverty may be associated with both child maltreatment and IPV victimisation (27). For example, some studies suggest that both exposure to child maltreatment and experiencing IPV share multiple risk factors including poverty, marital conflict, neighbourhood violence (28) and family mental illness (29), particularly maternal stress (30). Maternal relationship instability (31) and poor mental health (32) are also associated with child externalising problems (31) including aggression (32), which, in turn, are associated with child maltreatment (33) and IPV (34). This suggests that externalising problems (35) resulting from child maltreatment may operate through violent behaviour at early ages (36) leading to an increased risk of perpetration of, and/or victimisation to, IPV. Moreover, the experience of PTSD or disrupted relationships among those who have experienced child maltreatment may also affect self-image (37) resulting in an inability to develop skills to regulate emotions and form lasting relationships with other people. This perhaps might result from poor behavioural control in those who were the victims of child maltreatment involving patterns of vulnerability and a general mistrust of others (38). Finally, neighbourhood factors may operate via social disorganisation and collective efficacy (39) that may increase the likelihood of victimisation to child maltreatment and later IPV.

From the perspectives of *social learning* (40) and *learned helplessness* (41) theories, maltreated children may learn either to be perpetrators or victims (41) of violence in later stages of their lives. For example, child maltreatment and family violence may coexist (28) leading to poor psychosocial outcomes for children (42) including IPV. Those young adults who were maltreated during their childhood may also accept violence as an expected aspect or component of their adult relationships (43). Being a perpetrator and/or victim of IPV may also be considered a *learned* coercive conflict resolution mechanism and generalised from the parent- or caregiver-child relationship to the intimate partner relationship (14). Indeed, the *ecological/transactional* model (44) suggests that aforementioned factors, at individual, family and environment levels, may affect victimisation to both child maltreatment and IPV. Notwithstanding, only a few studies adjust for the aforementioned factors (45).

There are some important limitations associated with prior studies of the association between victimisation to child maltreatment and later IPV. These include the use of unstandardised self-report measures (19) of childhood maltreatment experiences that overlook multiple forms of maltreatment (2) from socially disadvantaged minorities (5). Reporting and recall bias (46) may therefore affect previous findings (47), as well as limiting generalisability (10). For instance, a recent systematic review (48) reported inconsistent associations between early child maltreatment and later IPV victimisation. Some studies focuson sexually (49) and physically (15) abused children and measure later IPV victimisation using non-validated tools in adolescent (50) or late adult (49) populations who have mental health disorders including PTSD (51). The findings of these latter studies may be confounded by other developmental or lifetime events. Few, if any of these studies have investigated the impact of a range of possible types of substantiated child maltreatment on later IPV victimisation (22) adjusting for both individual and familial (2) confounders. Finally, none of these studies have examined the association between distinct types of substantiated child maltreatment and victimisation to different forms of IPV in young adults.

The current study

Little is known about the extent to which experiencing multiple forms of substantiated child maltreatment increases the risk for intimate partner *polyvictimisation* in early adulthood controlling for potential confounders. In view of these limitations, several researchers have recommended the need for studies that use representative samples, standardised and psychometrically strong measures (16) with sufficient control for potential confounders and attention to possible gender differences in outcomes (9). Data for child maltreatment were substantiated for the childhood period. This study examines whether distinct types ofchild maltreatment differentially predict different forms of IPV victimisation controlling for gender at birth, as well as adolescence, early adulthood and familial confounders. Data on childhood maltreatment, maternal social and mental health from pregnancy to the age of 14 years and concurrent sociodemographic characteristics of the youth at 21 years enables us to explore more systematically the association between victimisation to childhood maltreatment and adulthood IPV victimisation.

Methods

Study design and participants

The study takes data from the MUSP, a prospective Australian pre-birth cohort of mothers and their children, recruited consecutively during their FCV from 1981 through to 1983 at Brisbane's Mater hospital. Since then, the study has followed mother-child pairs until when the children reached 21 years of age. Details on the MUSP are found elsewhere (52). The MUSP has previously linked this dataset to substantiated cases of child maltreatment reported to the

appropriate government agency up to the age of 14 years. For this study, we have extended the linkage of this dataset to the 21-year follow-up which includes details of IPV victimisation. The sample was restricted to those young adults who had had partners and reported details of possible IPV victimisation at the 21-year follow-up (n = 3322). Females comprised 55% of respondents.

Measures

Substantiated childhood maltreatment

Suspected cases of child maltreatment were identified from state-wide child protection records. Notifications of maltreatment include mandatory reports from medical practitioners and referrals received from the general public. In this birth cohort (n = 7223), there have been 789 (11%) notifications for any maltreatment, of which 663 and 500 are for abuse and neglect, respectively, after excluding 9 participants for which child protection data were not available. Reports are screened by the DFYCCQ. Substantiated cases of maltreatment include those cases confirmed by the DFYCCQ with evidence of "reasonable cause to believe that the child had been, was being, or was likely to be abused or neglected." The definition of sexual abuse includes "exposing a child to, or involving a child in, inappropriate sexual activities." Physical abuse is defined as "any nonaccidental physical injury inflicted by a person who had care of the child." Emotional abuse includes"any act resulting in a child suffering any kind of emotional deprivation or trauma." Finally, childhood neglect is defined as a "failure to provide conditions that were essential for the healthy physical and emotional development of a child." Childhood experiences of *neglect* were intended to incorporate both physical and emotional neglect by those who were taking care of a child (53). Queensland government child protection agency workers determined substantiations of child maltreatment. Data were confidentially and anonymously linked to the MUSP longitudinal database in September 2000. Details are presented elsewhere (54). In this study, substantiated cases of child maltreatment were restricted to 0–14 years of age, of which 55.8% females had experienced any substantiated maltreatment. Specific categories of child maltreatment were any substantiated maltreatment, substantiated sexual abuse, physical abuse, emotional abuse and neglect. This classification appears to have greater predictive validity (55).

Intimate partner violence victimisation

Intimate partner violence victimisation was assessed using 30 items ($\alpha = 0.95$) from the revised CAS (56). Participants were asked how often they had experienced violence in their relationship with a partner (in either current or previous relationships) followed by types of IPV. Each item has 7 response options for describing their abuse experience including no partner/never/only once/several times/once per month/once per week/daily. Those never ever partnered were excluded. For this study we used 22 items ($\alpha = 0.95$) that matched the validated

version (57) (Appendix 3, Table 3). Regardless of the number of items included, inter-item correlations remained similar. These included 11 items (α = 0.91) for emotional IPV (total score: 0–55), 5 items (α = 0.93) for physical IPV (total score: 0–25), 4 items (α = 0.83) for harassment (total score: 0–20) an d 2 items (α = 0.62) for severe combined abuse (total score: 0–10) based on the validated version of the CAS and recoded these as never = 0/only once = 1/several times = 2/once per month = 3/once per week = 4/daily = 5. The CAS reliably measures types and severity of IPV victimisation and has been validated for concurrent validity using a community-based sample (36). Frequencies of each form of IPV victimisation were summed to yield the total score. Finally, four composite indices of IPV victimisation (i.e., emotional IPV, physical IPV, harassment and severe combined abuse) were then generated based on recommended cutoff scores for each subscale (i.e., ≥ 3 emotional IPV victimisation, ≥ 1 physical IPV victimisation, ≥ 2 harassment and ≥ 1 severe combined abuse) to examine individual effects of child maltreatment on each form of IPV victimisation. Frequencies were recoded to create a composite variable with three categories–*never*, *only once and more than once*–to describe the frequency of IPV.

Sociodemographic characteristics of young adults

The dataset included information about the following sociodemographic characteristics: gender at birth, receipt of social security benefits, educational level, marital status and residential problem area at 21-year follow-up.

Social deprivation of young adults

The study also assessed social deprivation by asking if any of the following were problems in the area where they lived: vandalism/graffiti, house burglaries, car stealing, violence in the streets, unemployment, noisy and/or reckless driving, alcohol and drug abuse and school truancy. These were assessed using 9 items (α = 0.81) rated on five-point Likert scales and a 10% cutoff was considered to be a *high* problem area.

Aggressive behaviour at 14-year

The frequency of aggressive behaviour for the last one year was assessed using mothers' reports on 10 items (α = 0.85) from CBCL aggression short form (58) at 14-year. Mothers were asked how often their child had had a problem in the last year. Responses were rated and recoded as never = 1/sometimes = 2/often = 3. Responses to each item were summed and the top 10% cutoff was used as a *case* based on the relevant scale (59). There is some evidence to support the validity of the CBCL in school aged children of different settings (60). This variable was dichotomised as *normal* and *aggressive* and included in the analyses to test the possibility that for whether early aggressive behaviour is associated with child maltreatment and later involvement in IPV victimisation (61).

Maternal sociodemographic characteristics

The analyses included five maternal sociodemographic characteristics as reported by mothers from pregnancy through to when the child was 14 years old. First, their income was measured from pregnancy through to 5 years (4 follow-ups). The mean income of each phase was taken and those mothers whose income was consistently below the poverty line over the first 5 years were coded as *consistent poverty*, otherwise *mid-to-high income*. These thresholds were based on estimates of the poverty level from 1981–83 (62). Then, marital stability was assessed by whether mothers had the same partner at 14-year as they had at the birth of the child.

Maternal stress

Maternal perceived stress (63) from pregnancy through to 6-month was assessed using 4 items (α = 0.79, 0.83 and 0.84 for prenatal, postnatal and 6-month follow-up, respectively) that assessed nervousness, stressful activities and mental and physical exhaustion and found to have good constructive validity (64). Items were rated as never = 0; rarely = 1; some of the time = 2; most of the time = 3; and all the time = 4. Prenatal, postnatal and 6-month stress scores were added to provide a score of 0–16. A composite variable for chronic stress was dichotomised as *nil* (0–6 symptoms score) and *stress* (7–16 symptoms score).

Maternal negative life events

Mothers' NLEs from birth of the child until when he/she become 5 years of age were assessed using 9 items of the Life Events Scale (LES) (65) that ranged from 0 (no events) to 5 (life events for the last 5 years) at the 5-year follow-up. Negative life events included physical illness and various socioeconomic troubles. These items were summed to give a total score ranging 0–45. Those mothers who reported 0–3 and 4+ life events were recoded having had *nil* and *many* NLEs, respectively.

Family violence

Violence in the home was assessed at the 14-year follow-up using the modified Conflict Tactics Scale (66). This has 7 items (α = 0.69) asking whether disagreements at home were resolved with violent actions, items being recoded as never = 1; sometimes = 2; and often = 3. Scores were summed to provide a composite variable where higher scores represented *increased violence* (low = 1–15.9 versus high = 16–21). The test re-test reliability of this scale has been found to be consistent (67).

Data analysis

Descriptive statistics including percentage distributions and Pearson's chi-squared statistics were used to describe sociodemographic characteristics that were associated with each type of child maltreatment. Five separate sets of bivariate and multivariable logistic regression models, in which

all relevant variables entered at one stage, were then used to obtain the maximum likelihood estimates of the unadjusted and adjusted ORs with 95% CIs. The maximum likelihood ratio was used to test for model fit and significance. First, bivariate analyses for each predictor and confounder variable against each outcome measure were derived. Second, multivariable logistic regression models were calculated adjusting for 11 confounders to determine the independent effect of each predictor and confounder variable across four forms of IPV victimisation. Further, sensitivity analyses of associations between any child maltreatment notifications and multiple forms of IPV victimisation were examined adjusting for all selected confounders by repeating the same models to determine the independent effects of each child maltreatment type on IPV victimisation.

Attrition

To account for attrition, the investigators carried out weighted analyses (i.e., IPW) (68) in three steps. First, unadjusted logistic regression analyses of selected confounders against attrition as an outcome (*nonmissing* versus *missing*) were undertaken to identify those variables associated with higher rates of attrition. Second, multivariable logistic regression analysis was undertaken to determine independent predictors of attrition and to generate weights for each variable involved in the study. Third, the final fully adjusted model including the weighted variable was repeated to determine whether attrition has affected the findings.

Results

Descriptive statistics for the variables included in the study are provided in Table 1.The present study included 3322 participants who had complete data at the 21-year follow-up. The number of participants differed slightly across variables because of missing values. In bivariate analyses of attrition, aggressive behaviour at 14-year, mother's income, chronic stress, more NLEs and violence in the home at 14-year were all associated with attrition. Only sex maintained statistically significant association with attrition in the adjusted analysis (Table not shown).

Of the 3322 participants included in the study, 156 (5%) individuals had experienced substantiated childhood maltreatment. Substantiation of maltreatment appeared to be disproportionately reported by those who were receiving social benefits. Those individuals who had incomplete secondary school and who were divorced appeared to report higher rates of substantiated maltreatment. Moreover, those who were reported to exihibit aggressive behaviour at 14-year more often experienced maltreatment. Those young adults whose mothers met the criteria for chronic poverty, reported marital instability, and who had experienced stress and NLEs, were more likely to experience maltreatment (Table 2).

Table 1. Distribution of the variables included in the study, Brisbane, Australia.

Variables	Number	%
Sex at birth		
Male	1494	45.0
Female	1828	55.0
Receive social security benefits at 21-year		
No	2109	64.3
Yes	1170	35.7
Education at 21-year		
Incomplete	708	21.5
Secondary+	2588	79.5
Marital status at 21-year		
Never married	2596	77.0
Living together/married/separated-divorced-widowed	774	23.0
Residential problem area at 21-year		
Normal	2975	9.5
High	312	90.5
Aggression at 14-year		
Normal	2875	86.5
Aggressive	447	13.5
Chronic poverty up to 5-year		
Mid-to-high income	3297	96.5
Consistent poverty	115	3.5
Same partner as birth of child		
No	1442	43.4
Yes	1880	56.6
Chronic stress to 5-year		
Nil	1820	54.8
Some-to-many symptoms	1502	45.2
NLEs to 5-year		
Nil	2760	91.2
Many	562	9.8
Violence in home at 14-year		
Low	2997	83.1

High	325	16.9
Any substantiated maltreatment		
No	3166	95.3
Yes	156	4.7
Sexual abuse		
No	3276	98.6
Yes	46	1.4
Physical abuse		
No	3253	97.9
Yes	69	2.1
Emotional abuse		
No	3240	97.5
Yes	82	2.5
Neglect		
No	3255	98.0
Yes	67	2.0
Emotional IPV victimisation		
No	2230	67.2
Yes	1092	32.8
Physical IPV victimisation		
No	2012	59.6
Yes	1310	39.4
Harassment		
No	2509	76.5
Yes	813	24.5
Severe combined abuse		
No	3127	94.1
Yes	195	5.9
Frequency of IPV victimisation		
Never	1275	38.4
Only once	317	9.5
More than once	1730	52.1

The overall prevalence of physical IPV victimisation, emotional IPV victimisation, harassment and severe combined abuse was 39.4%, 32.9%, 24.5% and 5.9%, respectively. Of these,

52.1% of the respondents reported experiencing IPV more than once (Table 1) and 4% had experienced overlapping victimisation to all types of violence. Female participants, those who were on social benefits, were divorced, reported living in residential problem areas or experienced aggressive behaviour at 14-year were more likely to have experienced IPV. Those young adults with mothers who had experienced maternal marital instability up to the 14-year follow-up and who had reported more NLEs also reported a higher risk of experiencing later IPV. However, those living in families with more consistent poverty and stress over the first five years of life and who had experienced violence in the home at the 14-year follow-up did not show any significant associations with IPV victimisation (Table not shown).

At bivariate analyses, all forms of child maltreatment were consistently associated with subsequent IPV victimisation. For the *any substantiated maltreatment* category, percentages of subsequent IPV victimisation are about twice those of children not experiencing maltreatment (Table not shown).

Table 3 presents the unadjusted and adjusted associations between substantiated reports of child maltreatment and subsequent experience of IPV. Respondents who experienced any form of maltreatment were more likely to report that emotional and/or physical IPV was a characteristic of their current relationship. This remained the case after adjustment for a wide range of potential confounders, with the exception of sexual abuse where the associations were no longer significant. Some forms of child maltreatment were more strongly related to IPV victimisation. In particular, substantiated child emotional abuse and neglect were very strong predictors of nearly all forms of IPV victimisation in young adulthood. In further analyses, any substantiated child maltreatment notifications were significantly and consistently associated with subsequent IPV victimisation except for harassment where associations were slightly modified in adjusted models (Table 3). Sensitivity analyses using only notified reports of child maltreatment across all forms of IPV victimisation revealed consistent findings as that of substantiated cases (Table not shown). The findings remained robust and consistent after adjustment for the weighted data.

Table 2. Bivariate associations of baseline characteristics and any substantiated child maltreatment, Brisbane, Australia.

Variables	Not any child maltreatment		Any substantiated child maltreatment		χ^2 (df = 1) (*p*-value)
	Number	%	Number	%	
Young adult characteristics					
Gender at birth					
Male	1425	95.4	69	4.6	0.04
Female	1741	95.3	87	4.7	(0.85)
Receive benefits at 21-year					
No	2050	97.0	59	3.0	45.17
Yes	1077	92.1	93	7.9	(< 0.0001)
Education at 21-year					
Incomplete	632	89.3	76	10.7	77.04
Secondary+	2511	96.9	79	3.1	(< 0.0001)
Marital status at 21-year					
Never married	2494	90.1	102	9.9	14.71
Living together or married or separated-divorced-widowed	761	98.3	13	1.7	(< 0.0001)
Residential problem area at 21-year					
Normal	2851	95.8	124	4.2	2.34
High	292	95.7	20	4.3	(0.13)
Aggression at 14-year					
Normal	4115	95.5	193	4.5	64.29
Aggressive	387	86.6	60	13.4	(< 0.0001)
Maternal characteristics at early childhood to adolescence					
Chronic poverty to 5-year					
Mid-to-high income	3708	95.2	186	4.8	47.23
Consistent poverty	184	85.6	31	14.4	(< 0.0001)
Same partner as birth of child to 14-year					
No	1442	89.4	171	10.6	139.75
Yes	2994	97.5	76	2.5	(< 0.0001)
Chronic stress to 5-year					

Nil	4303	93.6	293	6.4	12.29
Some-to-many symptoms	1380	91.9	122	9.1	(0.002)
NLEs to 5-year					
Nil	3779	95.5	176	4.5	51.63
Many	496	88.3	66	11.7	(< 0.0001)
Violence in home at 14-year					
Low	3595	96.1	148	3.9	61.69
High	877	96.2	35	4.8	(< 0.0001)

Table 3. Unadjusted and adjusted ORs (95% CIs) of IPV victimisation by substantiated childhood maltreatment in young adults at 21-year (n = 3322), Brisbane, Australia.

Child maltreatment	Group	Model 1: Emotional		Model 2: Physical		Model 3: Harassment		Model 4: Severe combined abuse	
		UOR	AOR[a]	UOR	AOR[a]	UOR	AOR[a]	UOR	AOR[a]
Any substantiated maltreatment	No	1	1	1	1	1	1	1	1
Any substantiated maltreatment	Yes	2.37 (1.71–3.27)****	1.84 (1.31–2.57)****	2.78 (2.01–3.85)****	2.14 (1.51–2.99)****	1.67 (1.18–2.35)**	1.28 (0.89–1.83)	3.19 (1.99–5.09)****	2.12 (1.28–3.51)****
Sexual abuse	Yes	1.89 (1.07–3.36)†	1.48 (0.82–2.66)	2.75 (1.54–4.89)****	2.31 (1.27–4.18)**	1.63 (.89–2.99)	1.27 (.68–2.36)	3.48 (1.60–7.54)****	2.15 (0.9–-4.82)
Physical abuse	Yes	2.56 (1.58-4–13)****	1.84 (1.11–3.03)*	2.56 (1.58–4.15)****	1.76 (1.06–2.92)*	1.64 (0.98–2.72)	1.15 (0.56–1.95)	2.96 (1.49–5.89)****	1.69 (0.82–3.53)
Emotional abuse	Yes	4.09 (2.58–6.49)****	3.19 (1.99–5.14)****	3.65 (2.31–5.78)****	2.76 (1.72–4.43)****	2.12 (1.35–3.33)***	1.63 (1.02–2.59)*	5.55 (3.25–9.48)****	3.97 (2.24–7.04)****
Neglect	Yes	3.53 (2.12–	2.64 (1.58–	3.81 (2.29–	2.74 (1.62–	1.96 (1.19–3.24)*	1.44 (0.86–2.42)	6.75 (3.85–	4.62 (2.51–

	5.82)****	4.42)****	6.33)****	4.63)****				11.84)****	8.52)****	

UOR = unadjusted OR; AOR = adjusted OR.

[a]Adjusted for child gender, receiving benefits, educational levels, marital status, residential problem area at 21-year and aggressive behaviour at 14-year, maternal income over the first five years, same partner at 14-year as birth of child, chronic stress over first 6 months, NLEs over the first five years and violence in home at 14-year.

*$p < 0.05$; **$p < 0.01$; ***$p < 0.001$; ****$p < 0.0001$.

Discussion

Childhood maltreatment has been found to lead to later problem behaviours including aggression (69) and IPV victimisation (2). Notwithstanding, the health consequences of victimisation to multiple forms of childhood maltreatment (22) especially for early adulthood occurring and overlapping forms of IPV victimisation have been neglected. Furthermore, prior literature has been largely based on retrospective reports of exposure to child maltreatment (46) from preselected samples of socially disadvantaged minorities (5) with PTSD (51) and failed to control for potential individual, familial and environmental level confounders (2), limiting reliability, validity (10) and generalisability. The current study investigated the association between substantiated child maltreatment and multiple forms of IPV in young adults, using a linked dataset from a child protection agency.

The analyses point to four major findings. First, child physical abuse, emotional abuse and neglect are associated with experiencing later emotional IPV. Second, child sexual abuse, physical abuse, emotional abuse and neglect predict later risk for physical IPV. Third, emotionally abused and neglected children have higher subsequent rates of combined IPV. Finally, emotional abuse predicts harassment. The findings may point to both specific and cumulative effects of child maltreatment on IPV victimisation because multiple types of child maltreatment consistently predict IPV victimisation. Moreover, the findings suggest the sustained effects of maltreatment on IPV in later life. These results confirm prior findings of the associations between child physical abuse (2), emotional abuse (35) and neglect (6), and later IPV experiences.

The current study has a number of strengths. First, it uses a prospective large dataset of mother-child dyads from pregnancy to the age of 21 years old. This enabled us to control for potential confounders at individual, family and environment levels. Second, unlike most prior studies, our analyses only used linked child protection agency records of substantiated child maltreatment cases, providing an objective measurement of child maltreatment and reducing the chance of recall bias (70). The substantiated cases were then hierarchically grouped to represent each form of child maltreatment (55). Third, we used a well validated tool to measure subsequent occurring IPV victimisations that may enhance the reliability and validity of our findings. Fourth, we undertook simultaneous examinations of mutually non-exclusive and overlapping categories of child maltreatment against subscales of IPV victimisations. Finally, and to our knowledge, this is the first study that addresses specific forms of substantiated child maltreatment and their effect on four different forms of IPV victimisation experienced during early adulthood using a validated tool.

Despite the above strengths, the study has a number of limitations. Our reliance on substantiated measures of maltreatment may underestimate the actual levels of maltreatment (71) and involve biases inherent in official reporting and recording procedures (51). This may have led to unrecorded cases and an over representation of the severest forms of child maltreatment. On the other hand, there is evidence that later health outcomes are similar irrespective of whether cases are unsubstantiated self-reports or substantiated (72). Overlap across different forms of child maltreatment may also overlook the independent effects of each type of maltreatment. It is also acknowledged that there is significant overlap across both child maltreatment and IPV perpetration/victimisation events that made it difficult to conduct more refined subgroup analyses. For instance, our analyses did not differentiate on whether IPV was male on female or vice versa. This may bias the findings as to the rates and patterns of being a victim and/or perpetrator of IPV and whether these may differ across gender. However, a focus on perpetrators and victims of IPV may be misleading as it may occur from male on female (73) or vice versa (74). Moreover, it is likely that victims and perpetrators are in a relationship and IPV may be a characteristic of some intimate relationships (75), and the boundaries between being a perpetrator and victim are blurred with similar risk factors for both. Answering these questions in maltreated individuals requires further study. Finally, given the prospective recording of maltreatment throughout the childhood period and its overlap with subsequent early life adversities (36), the study could not determine the possible developmental pathways through which child maltreatment leads to IPV experiences.

There may be a number of explanations for these findings. For instance, the consistent and strong effect of child emotional abuse and neglect may be due to the deleterious effect these types of maltreatment have on emotional development (35) that, in turn, induce IPV (76). This may reflect the cumulative emotional impact of any form of maltreatment (76) increasing the risk of experiencing or committing IPV. The concern, however, is emotional abuse and neglect do not attract the same level of concern unless accompanied with other forms of child maltreatment (76). In contrast to previous findings (77), the association between sexual abuse and later emotional IPV victimisation was not significant in our study. This is not to say the two are unrelated. Possible reasons for this negative finding include the underreporting of sexual abuse to child protection authorities (51) as a consequence of the secretive nature of sexual abuse as compared to other types of maltreatment (78). Victims' feelings of guilt and shame to the known perpetrators who mostly are intimate family members may further hinder disclosure of sexual abuse cases to child protection authorities (72). Finally, children who are sexually abused tend to be abused in other ways as well.

Individual, family and environmental characteristics might have either a confounding or mediating effect or both in the associations between child maltreatment and IPV victimisations. Consistent with other studies (77), exposure to early child maltreatment and later IPV victimisation are consistently skewed to socially disadvantaged young adults who were reared by mothers from more disadvantaged backgrounds. Social and/or psychological disorders and NLEs in the family (79) predict both child maltreatment and IPV (80). However, after adjusting for all selected confounders including residential problem area and aggressive behaviour, child maltreatment remains strongly and independently associated with IPV victimisation. Therefore, disadvantaged backgrounds, aggressive behaviour during adolescence and currently living in a residential problem area do not explain the observed associations and do not seem to mediate the relationships between child maltreatment and IPV victimisation.

Moreover, although this study could not test for possible pathways that link childhood maltreatment to later IPV experiences, some emerging developmental-oriented studies have suggested a number of mechanisms that may lead to later IPV experiences for those maltreated as children (81). Literature has suggested that exposure to severe child maltreatment such as *polyvictimisation* may lead to later IPV experiences (82). This may be coupled with overlapping vulnerability (83) to poor social and mental health outcomes (82), and adolescent dating violence (50). For example, child maltreatment may be associated with poor mental health (84) and behavioural problems including distress (81), distorted belief about violence and affiliation with deviant peers (85), all contributing to IPV experiences. This has been observed in child physical abuse survivors (85). Moreover, child maltreatment and physical and psychological IPV experiences have both been associated with some forms of disabilities including deafness and difficulty hearing (86). This may be due to an inability to seek help (87) and a lack of access to preventative measures of violence including health education (88). This may further be explained from the perspective of *target vulnerability* (89), where escaping from the *harm* becomes less for those handicapped due to their underlying disabilities, which, in turn, may increase the propensity for later IPV experiences. Genetic factors (90) may also interact with child maltreatment and lead to later violence perpetration and/or victimisation.

Collectively, the evidence suggests a detrimental effect of child maltreatment on multiple forms of later IPV victimisation. Appropriate interventions for child maltreatment may mutually mitigate later involvement in IPV in adulthood. In recognition of this, the WHO recommends screening for prior exposure to maltreatment in individuals who have experienced IPV (91). There is also a need to

understand more about the particular characteristics of those who have experienced child maltreatment but who did not engage in later IPV.

Conclusion

Childhood physical abuse, emotional abuse and neglect are chronic adversities that appear to lead to physical IPV, emotional IPV, harassment and multiple forms of IPV victimisation in adulthood. The ability to examine the associations between specific forms of child maltreatment and four different forms of IPV experiences, especially severe intimate violence, advances the current state of knowledge in this area. The associations between child maltreatment and subsequent IPV are consistent and strong but also complex and multiple. Further research may examine possible pathways that link exposure to childhood maltreatment and later IPV experiences, which could also address the peculiar characteristics of those who have experienced child maltreatment but who did not engage in later IPV.

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Childhood maltreatment and gender differences in delinquency

Published manuscript (click here to access full length article) and cited as:

Abajobir AA, Kisely S, Williams G, Strathearn L, Clavarino A, Najman JM. Gender differences in delinquency at 21 years following childhood maltreatment: a birth cohort study. Pers Individ Differ. 2017;106:95–103.

Objective: The study was designed to determine whether specific and combined multiple forms of substantiated childhood maltreatment and the frequency of episodes of substantiation to maltreatment were associated with gender differences in rates of delinquency.

Supplementary analyses: Data pertaining to flow of the study, predictors of loss to follow-up, and bivariate associations between confounders and delinquency were published online and available at: http://dx.doi.org/10.1016/j.paid.2016.10.020.

Abstract

Childhood maltreatment and youth delinquency are major public health problems. The present study examines the association between exposure to agency-substantiated childhood maltreatment from 0 to 14 years of age and delinquency at 21 years in males and females separately. The study uses data from the MUSP, an Australian pre-birth longitudinal cohort of mothers and their children. Pregnant women were recruited consecutively at their FCV at Brisbane's Mater hospital from 1981–83. We linked substantiated cases of childhood maltreatment, reported to the appropriate child protection services between birth and 14 years of age, to the 21-year survey follow-up. The study sample comprises 1810 males and 2008 females, who had complete data on delinquency at the 21-year follow-up. The odds of delinquency at the 21-year follow-up were 4–6 times higher for maltreated children in the unadjusted models. In the adjusted models, physical abuse, emotional abuse and neglect, as well as emotional abuse with or without neglect were associated with over 3 times a greater risk of delinquency in males. More frequent maltreatment was associated with double the risk of later delinquency in males. However, none of the maltreatment subtypes, nor was the frequency of maltreatment substantiations associated with an increased risk of delinquency in females. Exposure to any childhood maltreatment increased the likelihood of delinquency for males but there was no difference for females. Childhood maltreatment is associated with an increased risk of later delinquency for young adult males, but not females.

Keywords: substantiated childhood maltreatment, delinquency, gender differences, birth cohort study

Introduction

Childhood maltreatment has been associated with a wide range of adverse childhood developmental outcomes including antisocial behaviour and substance misuse (1, 2). However, very little of this research has specifically addressed gender differences,either in the type of childhood maltreatment (e.g., sexual, physical, emotional abuse or neglect) and subsequent outcomes (3).

Antisocial behaviour including delinquency is a major public health challenge in Australia (4). It is estimated that up to 18.9% of boys and 17.7% of girls of school age manifest a range of delinquent behaviours (5). Similarly, childhood maltreatment is also a major public health problem costing $3.3 billion in Australia in 2013–14 alone (6). About 1 in 10 children are reported to experience childhood maltreatment in Queensland alone, and 1 in 20 of these maltreated children experience a court recorded juvenile offence by the age of 17 (7). Despite this high public health burden, there is limited research on the association between childhood maltreatment and delinquency, particularly using a prospective cohort study design.

Retrospective studies using self-reported measures have suggested that exposure to multiple forms of childhood maltreatment (8) including sexual (8), physical and emotional (9, 10) abuse may lead to delinquency (8, 9). For example, studies of high school youth aged from 13–18years (11), and youth aged 20 years (12) found childhood maltreatment (11, 12), in general, and neglect (12) in particular, was associated with delinquent behaviour (11, 12). However, in other studies, neither childhood maltreatment that involved sexual, physical and emotional (12) abuse in isolation, nor multiple forms of childhood maltreatment (13), were associated with increased delinquency (12, 13). Few, if any previous studies have specifically linked different types of childhood maltreatment to subsequent delinquency (8, 9, 11), and few previous studies adequately controlled for potential confounders (11-13). Previous studies also tend to use official records of delinquency (1), although these may underestimate the actual population-level magnitude of delinquent behaviour (14).

In one prospective study of 908 individuals, substantiated childhood maltreatment increased the risk of delinquency leading to juvenile arrest, adult arrest and violent crime by 59%, 28% and 30%, respectively, by the age of 25 years (1). In another, substantiated maltreatment in childhood or adolescence predicted general delinquency that was 39% and 41% higher than the level experienced by nonmaltreated counterparts (15). Similarly, chronic sexual abuse (16), physical abuse (17) and neglect (16) have been found to predict delinquency in adolescence, after controlling for other forms of maltreatment (16). All these studies suggest that persistent maltreatment in adolescence may have more consistent negative consequences than maltreatment restricted to the childhood period (18), even

although childhood-only maltreatment may also predict subsequent delinquency. For instance, maternal reports of physical abuse before the age of 5 years predicted twice the rates of violent and nonviolent delinquency at the age of 18 years in a sample of 574 youths (19). Similarly, the Add Health Survey of 3472 young adults, found that retrospective recall of sexual abuse and neglect were associated with delinquency in the previous year (20). The one exception is emotional abuse where studies have failed to find an association with subsequent delinquency (16). Unfortunately, few previous studies include details of multiple forms of childhood maltreatment (17), nor they do specify each form of maltreatment. Few previous studies control for early and concurrent individual, family and environmental level potential confounders (15).

Gender differences in childhood maltreatment and subsequent delinquency have not been specifically addressed, even though there may be different gender pathways to delinquency. For example, females may show less delinquent behaviour because of less exposure to peers with similar behaviour, or because they are more likely to report strong social bonds and greater parental supervision than males (21). Conversely, males may experience greater risk including exposure to delinquent older siblings (22) and less protection (23). Males and females may also respond differently to NLEs and may engage differently in different types of delinquency manifestations (24). Moreover, there is a possibility of an interface between biological and social risk factors (25), which may operate via their effect either on early or delayed long-term developmental problems (26). Despite some evidence that the genders may have converging patterns of delinquency (21), and/or that there may be shared underlying psychosocial factors (23) including victimisation (27), males and females may respond differently to the same forms of childhood maltreatment. For example, sexually abused males and females may manifest differing patterns of psychopathology (28) attributable to differential responses (29) and adaptations (28) to the effects of abuse (30). The effect of childhood maltreatment may also be mediated by internalising problems (31) and social withdrawal (32) in females but, conversely, lead to externalising (31) and attention seeking (32) in males. These gender differences in outcomes may explain the varying levels of antisocial behaviour. The pattern of offence may also differ depending on the type of childhood maltreatment such that physically abused males may engage in property, felony and violent offenses whereas femalesmay experiencemore internalising symptoms (31). Studies to date have not adequately addressed the differential effects of each substantiated childhood maltreatment on delinquency for males and females separately.

Some studies have also identified specific sociodemographic predictors including poor school achievement, racial background, maternal teenage pregnancy, marital instability, family poverty at

childhood, familial arrest for offences and neighbourhood social deprivation that may be associated with both childhood maltreatment and later antisocial behaviour, including delinquency (33-40). These factors may be related to both exposure to childhood maltreatment and subsequent delinquency. One study suggested that childhood maltreatment reduces the rate of high school completion while employment and marriage are associated with a decrease in adult arrests (38). Race or ethnic background may also be associated with delinquency in maltreated individuals (39, 40), although other researchers do not find such differences (41-43). Moreover, teenage motherhood (33), marital instability (34) and family poverty in the childhood period (35) are associated with childhood maltreatment, which are also associated with delinquency (35-37). Parental criminal offenses and subsequent arrest have also been found to be associated with childhood maltreatment (44). Parenting styles including low parental warmth and supervision, may involve allowing a child to engage in frequent television viewing and physical discipline (45), which are associated with childhood maltreatment including neglect (45) and delinquency (46). There is also some evidence that neighbourhood disadvantage has been associated with childhood maltreatment (47)and delinquency (48)perhaps reflecting social disorganisation (47) leading to higher rates of delinquency. Indeed, the *ecological*/*transactional* model (49) suggests that a range of factors at individual, family and environment levels may affect both childhood maltreatment and delinquency, and account for their association.

There are a number of unresolved issues concerning the associations between childhood maltreatment and adult delinquency. These include methodological limitations such as retrospective designs and unrepresentative samples (50). For instance, retrospective self-reports of childhood maltreatment may be biased when provided by individuals to account for their antisocial behaviour (50), blurring the temporal sequence and limiting the capacity to make causal inferences (51). Despite the fact that significant victimisation to multiple forms of maltreatment may exist (7) and an overlap of victimisation may occur between childhood and adolescence (52), previous studies of the association between childhood maltreatment and delinquency focus on a single form of maltreatment (17, 19) including adolescence-maltreatment only (18). There is also a possibility that either childhood or adolescence-only maltreatment may be associated with differing outcomes (53). Although there is a need to understand the effects of different types of maltreatment (11), prior studies do not consider both specific (54) and all types of childhood maltreatment (12). Although childhood maltreatment is potentially a chronic exposure (7, 55), prior studies have given little attention to measuring the frequency, duration and/or intensity of this exposure up to late childhood and adolescence.

Additionally, despite developmental concerns about childhood maltreatment and its outcomes (56), the association between childhood maltreatment and young adulthood delinquency is rarely addressed. Some studies have focussed on official records of juvenile delinquency (7, 57), though this may significantly underestimate (14) the actual rate of delinquency at population level. Only a few prior studies of childhood maltreatment and delinquency have adjusted for individual and family backgrounds, and environmental characteristics that may be associated with child maltreatment and may also tend to lead to later delinquency. Importantly, little is known about gender differences in the association between childhood maltreatment and delinquency (16, 58, 59), especially in a population-based samples.

The present study uses data from a 21-year pre-birth cohort study examining the association of exposure to agency-substantiated childhood maltreatment from age 0 to 14 years and delinquent behaviour at 21 years of age. The study was designed to determine whether specific and combined multiple forms of substantiated childhood maltreatment and the frequency of episodes of substantiation to maltreatment were associated with gender differences in rates of delinquency. For this report, we considered overlapping childhood maltreatment experiences while examining the distinctive effect ofeach maltreatment type. This study addresses the relationship between prospectively substantiated specific as well as multiple forms of childhood maltreatment and delinquency, adjusting for a range of individual, familial and environmental level confounders. Moreover, we determined the association between frequency of substantiated childhood maltreatment and delinquency.

Methods

Study design and participants

We followed the STROBE guidelines to present the study approach and our respective findings (60). The study takes data from the MUSP, a prospective Australian pre-birth cohort of mothers and their children, recruited consecutively during their FCVto the Mater hospital, Brisbane from 1981 through to 1983. A total of 7223 mothers gave birth to a live singleton baby, who neither died nor was adopted prior to leaving the hospital. Mothers were prospectively interviewed at 3–5 days postpartum and again when the child was 6 months, 5, 14 and 21 years of age (61, 62). The study links this dataset to substantiated cases of child maltreatment reported to the appropriate government agency up to the age of 14 years. It then extended the linkage of this dataset to the 21-year follow-up which had self-report survey data on delinquency. The sample was restricted to 3818 participants who had complete data on delinquency at the 21-year follow-up (Online Supplementary Figure 1).

Measures

Substantiated childhood maltreatment

Suspected cases of child maltreatment were identified from state-wide child protection records. Notifications of maltreatment include mandatory reports from medical practitioners and referrals received from the general public. Reports are screened by the DFYCCQ. Substantiated cases of child maltreatment include those cases confirmed by the DFYCCQ with evidence (usually site visit) of "reasonable cause to believe that the child had been, was being, or was likely to be abused or neglected." The definition of sexual abuse includes "exposing a child to, or involving a child in, inappropriate sexual activities." Physical abuse is defined as "any nonaccidental physical injury inflicted by a person who had care of the child." The definition of emotional abuse includes "any act resulting in a child experiencing any kind of emotional deprivation or trauma." Finally, childhood neglect is defined as a "failure to provide conditions that were essential for the healthy physical and emotional development of a child" and designed to include both physical and emotional neglect (63). Then, numbers and types of child maltreatment were determined by child protection caseworkers employed by the Queensland government child protection agency. Data were confidentially and anonymously linked to the MUSP longitudinal database in September 2000 (64). In this study, substantiated cases of child maltreatment were restricted to those occurring between 0 and 14 years of age. Child maltreatment events were dichotomised and coded as *no maltreatment* versus *substantiated maltreatment*. Specific categories of child maltreatment included substantiated sexual abuse, physical abuse, emotional abuse and neglect. This classification appears to have greater predictive validity in predicting developmental outcomes (65). Given the overlap among subtypes of maltreatment, sexual and/or physical abuse, and emotional abuse and/or neglect were created to examine their association with delinquency (55). Moreover, to distinguish the specific effects of each form of maltreatment, a composite variable was created. For example, a variable was created that excluded substantiated sexual abuse from one or more combinations of physical abuse, emotional abuse and neglect to adjust for sexual abuse and so on. Likewise, in multiple forms of child maltreatment, those which were not included in a particular category were used to adjust and rule out possible overlaps. The study also uses the severity of child maltreatment as measured by frequency of substantiation to maltreatment to predict the outcome.

Delinquency

The study assessed self-reported delinquency over the past 6 months using YASR behaviour checklist (66) at the 21-year follow-up. The YASR is a self-report designed to measure problem

behaviours (66). There were 9 items (α = 0.72) for the delinquency scale including: *I use drugs (other than alcohol) for nonmedical purposes, I destroy things belonging to others, I break rules at work, where I study, or elsewhere, I hang around with others who get into trouble, I lie or cheat; I steal, I drink too much alcohol or get drunk, I do things that may cause me trouble with the law, and I fail to pay debts or meet other financial responsibilities*. These items were administered to assess delinquent behaviour with 3 response options: *0 = not true*; *1 = somewhat or sometimes true*; and *2 = very or often true*. Responses were summed up with a higher score representing cases. The study used the Achenbach derived clinical cutoff (66), and respondents who met the clinical cutoff were coded *1*, otherwise *0*. There is a reasonable evidence that maltreated individuals are found to reliably self-report antisocial offenses that are not known to authorities (14).

Parental characteristics from early childhood through adolescence

The analyses included maternal sociodemographic characteristics as reported from pregnancy through to when the child was 14 years old. The age of the mothers (*20+/13-19* years) and paternal or maternal racial origin (*White/Non-white*) at pregnancy were recorded. Mothers were also asked whether they had ever been arrested for any offenses over the first 5 years of their child's age (*no/yes*). Marital stability was assessed by whether mothers had the same partner at the 14-year as they had at the birth of the child (*no/yes*). To assess the level of parental supervision provided to the child to the age of 5 years, mothers were asked the age at which they had allowed their child to travel on a bus alone, go to the movies with a friend, go on a holiday with group of friends of the same age (unsupervised), stay alone in the house while they were away and drink alcohol (α = 0.73). These items were recoded and means were summed such that higher scores represent high control of the child or giving the child lots of freedom.

Young adult characteristics at 21-year

We collected information from participants about the following sociodemographic characteristics: gender at birth (*male/female*), educational level (*complete/incomplete high school*) and they were living in a problem neighbourhood. This was assessed by asking if any of the following were problems in the area where they (the participant) lived: vandalism/graffiti, house burglaries, car stealing, violence in the streets, unemployment, noisy and/or reckless driving, alcohol and drug abuse and school truancy. These were assessed using 9 items (α = 0.81) rated on five-point Likert scales and a 10% cutoff was considered to be a *high* residential problem area and dichotomised into *normal* versus *high*. These are concurrent measures, except gender, with the outcome variable, and as such these

variables may not have confounded child maltreatment, that had been prospectively recorded for the first 14 years but rather considered as covariates in this study.

Analyses

Descriptive statistics including percentage distributions and Pearson's chi-squared statistics were used to determine the prevalence of child maltreatment and delinquency and describe baseline maternal and young adult characteristics and child maltreatment experiences, as well as subgroups of child maltreatment as these characteristicsare associated with delinquency. Binary logistic regression analyses (Model 1) were used to examine the relationships between each single and co-occurring forms of child maltreatment and delinquency. Then, three progressive sets of multivariable logistic regression models (Models 2 through 4) were developed with each of the seven categories of child maltreatment as the main predictor variables and delinquency as the outcome variable, controlling for confounders and overlap of child maltreatment variables in step-by-step analyses. The three steps employed in progressive multivariable logistic regression were: first, maternal sociodemographics, youth educational status and residential problem area. Second, maternal ever arrest for any offense and parental supervision over the first 5 years of age were included in the above model. Finally, a childhood maltreatment variable that excludes a particular predictor variable of interest in that model was included to control for overlaps. The final model was applied while examining the association between specific type of maltreatment and delinquency but not the*any maltreatment* group. Cox and Snell R Square (67) was used to test for model fit. We chose hierarchical regression analyses to determine the stability of prediction of childhood maltreatment after adjustment for confounders and overlapping forms of maltreatment. The estimates of the unadjusted and adjusted ORs with 95% CIs of young adults for last six-month delinquency (reference group was young adults who do not report delinquency) were used to present the results with a reference level of *not any maltreatment*. Combined initial bivariate exploratory analyses were conducted for male and female samplesto determine gender differences.Tests for a gender difference in the association between males and females were assessed by computing a likelihood ratio test of the interaction with gender. We carried out a series of multiple logistic regressions that controlled for early maternal and adulthood sociodemographics, maternal arrest over the first five years and parental supervision at 5-year, and overlapping child maltreatment variables for males and females separately. Additionally, the first three models were employed to examine the association between frequency of child maltreatment substantiation and delinquency.

Lost to follow-up

Of the 7223 baseline cohort, 3818 (52.9%) young people completed data on delinquency at the 21-year follow-up. To account for loss to follow-up, weighted analyses was carried out using IPW (68). Binary and multivariable logistic regression analyses of individual and family level confounders against loss to follow-up as an outcome (*complete* versus *loss to follow-up*) were employed to identify those variables associated with higher rates of loss to follow-up. Then, the multivariable logistic regression analysis was used to generate weights for each variable involved in the study. Finally, the study repeated the fully adjusted final model including the weighted data to determine whether loss to follow-up affected the findings.

Results

Table 1 indicates the distributions of variables included in the study. The study included 3818 participants who had complete data on delinquency at the 21-year follow-up. All early stage confounders included in the study predicted higher rates of loss to follow-up ($p < 0.0001$), though multivariate analysis of loss to follow-up slightly moderated the statistical significance of maternal age, maternal education, maternal or paternal racial origin at pregnancy and parental supervision at 5-year. Maternal marital instability from the birth of a child up until the age of 14 years and ever arrest for any offences over the first 5 years of age, as well as gender as recorded at birth predicted loss to follow-up (Online Supplementary Table 1). These factors did not vary by gender (Table not shown).

There were a total of 789 notifications for any childhood maltreatment. A substantial proportion of participants with substantiated childhood maltreatment were lost to follow-up. Of the 512 substantiated cases of any childhood maltreatment, only 4.4% (n = 172) participants remained for this study. Females were found to experience maltreatment more often than males, although the differences were not large. Of those children identified as having been exposed to substantiated cases of abuse and neglect, 4.2% and 4.8% were males and females, respectively. Maternal sociodemographics at pregnancy to the age of 14 years including young age at pregnancy ($\chi^2 = 80.5$ (df = 1); $p < 0.0001$), having had incomplete high school ($\chi^2 = 101.1$ (df = 1); $p < 0.0001$), ever arrested for any offenses over the first 5 years ($\chi^2 = 22.8$ (df = 1); $p < 0.0001$) and having had unstable marriage up to the age of 14 years ($\chi^2 = 152.8$ (df = 1); $p < 0.0001$) increased the likelihood of any childhood maltreatment. Socioeconomic disadvantage such as lower educational status ($\chi^2 = 82.3$ (df = 1); $p < 0.0001$) at 21-year also increased the likelihood of victimisation to any maltreatment in both genders.

Table 1. Distribution of variables in the study, Brisbane, Australia.

Variables	Male (n = 1810)	Female (n = 2008)	*p*-value
Maternal age at pregnancy (in years)			
20+	87.7	86.2	0.2
13–19	12.3	13.8	
Maternal education at pregnancy			
High school+	83.9	84.2	0.8
Incomplete high school	16.1	15.8	
Mother's partner same as birth of child to 14 years			
No	70.2	67.8	0.1
Yes	29.8	32.2	
Maternal or paternal racial origin at pregnancy			
White	92.3	92.5	0.8
Non-white	7.7	7.5	
Maternal ever arrest for any offences up to the age of 5 years for a child			
No	83.2	81.2	0.05
Yes	6.8	8.8	
Parental supervision of a child at 5 years			
Controlled	5.1	6.9	0.03
Some/lots freedom	94.9	94.1	
Youth education at 21 year			
High school+	75.5	82.2	< 0.0001
Incomplete high school	24.5	17.8	
Youth neighbourhood problem area at 21 year			
Normal	90.1	90.9	0.4
High	9.9	9.1	
Any substantiated child maltreatment			
No	95.8	95.2	0.849
Yes	4.2	4.8	

Sexual abuse			
No	99.4	97.8	< 0.0001
Yes	.6	2.2	
Physical abuse			
No	97.8	98.0	0.628
Yes	2.2	2.0	
Emotional abuse			
No	97.7	97.6	0.798
Yes	2.3	2.4	
Neglect			
No	98.0	98.0	0.475
Yes	2.0	2.0	
Sexual +/- physical abuse			
No	97.5	96.2	0.034
Yes	2.5	3.8	
Emotional abuse +/- neglect			
No	96.6	96.6	0.462
Yes	3.4	3.4	
Delinquency at 21 year			
No	95.3	96.4	0.008
Yes	4.7	3.6	

Of the total 3818 participants, 4.2% (n = 161) met the clinical criteria for delinquency at 21-year, this being 4.8% and 3.7% of males and females, respectively. Maternal ever arrest for any offences over the first 5 years of age, marital instability up until 14 years of age, and having had incomplete high school and concurrent residential problem area at 21-year follow-up increased the likelihood of later delinquency in both genders (Online Supplementary Table 2). Specific and multiple forms of maltreatment predicted later delinquency. There was statistically significant gender difference in the association of any childhood maltreatment and delinquency at the age of 21 years (p = 0.01). This pattern was similar across all subtypes of maltreatment including the experience of multiple forms of childhood maltreatment. The combination of emotional abuse with or without neglect was more strongly associated with an increased risk of delinquency relative to each specific types of childhood maltreatment (Table 2).

Table 2. Bivariate associations between substantiated childhood maltreatment and delinquency by gender, Brisbane, Australia.

Variables	Delinquency in males			Delinquency in females			*p*-value*
	No; number (%)	Yes; number (%)	χ^2 (df = 1) (*p*-value)	No; number (%)	Yes; number (%)	χ^2 (df = 1) (*p*-value)	
Any substantiated maltreatment[a]	1668 (95.8)	75 (4.2)	21.09	1857 (96.3)	72 (3.7)	0.71	0.018
No	64 (84.2)	12 (15.8)	(< 0.0001)	94 (97.9)	2 (2.1)	(0.40)	
Yes							
Sexual abuse							
No	1721 (95.2)	86 (4.8)	0.45 (0.50)	1908 (96.3)	73 (3.7)	0.24	0.833
Yes	10 (90.9)	1 (9.1)		43 (97.7)	1 (2.3)	(0.62)	
Physical abuse							
No	1700 (94.6)	79 (4.4)	21.64	1911 (96.3)	73 (3.7)	0.18	0.008
Yes	31 (79.5)	8 (20.5)	(< 0.0001)	40 (97.6)	1 (2.4)	(0.68)	
Emotional abuse							
No	1697 (94.6)	79 (4.4)	19.19	1903 (96.3)	73 (3.7)	0.37	0.018
Yes	34 (81.0)	8 (19.0)	(< 0.0001)	48 (98.0)	1 (2.0)	(0.54)	
Neglect							
No	1702 (95.5)	80 (4.5)	17.32	1914 (96.4)	72 (3.6)	0.25	0.005
Yes	29 (81.6)	7 (19.4)	(< 0.0001)	37 (94.9)	2 (5.1)	(0.62)	
Sexual +/- physical abuse	1694 (95.5)	79 (4.5)	17.09	1877 (96.3)	72 (3.7)	0.24	0.043

No	37 (82.2)	8 (17.8)	(< 0.0001)	74 (97.4)	2 (2.6)	(0.63)	
Yes							
Emotional abuse +/- neglect							
No	1681 (95.7)	76 (4.3)	24.31	1892 (96.3)	72 (3.7)	0.03	0.002
Yes	50 (82.0)	11 (18.0)	(< 0.0001)	59 (96.7)	2 (3.3)	(0.87)	

[a]Any childhood maltreatment included one or more combination of neglect, sexual, physical or emotional abuse.

*Likelihood ratio test of the interaction term of gender and childhood maltreatment in predicting delinquency.

Bivariate results indicated that the rates of later delinquency for maltreated males and females were systematically different. Therefore, subsequent regressions were estimated separately for males and females. In males, any form of substantiated childhood maltreatment, except sexual abuse, was associated with increased risk of later delinquency in both bivariate and subsequent multivariable logistic regression models that progressively adjusted for selected confounders and overlapping types of maltreatment. In Model 1, the OR of delinquency ranged from 4.15 for any maltreatment to 5.52 for physical abuse. Subsequent adjustment for maternal and young adults' sociodemographic characteristics, maternal arrest, parental supervision and overlapping childhood maltreatment subcategories did not attenuate these associations. Physical abuse, emotional abuse and neglect, as well as emotional abuse with or without neglect were associated with over a 3 times greater risk of delinquency in males. More frequent maltreatment represented by 2 or more instances of substantiations was also associated with a 2 times increased risk of later delinquency. The inclusion of emotional abuse with or without neglect in the final model, however, slightly moderated the association between sexual with or without physical abuse and delinquency. In females, none of the maltreatment types increased the risk of delinquency (neither multiple forms nor frequency of substantiations to childhood maltreatment substantiation) (Tables 3–5).

Table 3. Progressive bivariate and multivariable logistic regression associations between each substantiated childhood maltreatment category and delinquency in males (n = 1810) at 21-year, Brisbane, Australia.

Childhood maltreatment	Category	Unadjusted OR (95% CI)	Adjusted OR (95% CI)		
		Model 1	Model 2	Model 3	Model 4
Any maltreatment	No	1	1	1	1
Any maltreatment[a]	Yes	4.15 (2.15–8.01)****	2.94 (1.45–6.03)**	2.95 (1.45–6.04)**	-
Sexual abuse	Yes	1.99 (0.25–15.73)	1.06 (0.12–9.64)	1.06 (.12–9.66)	1.23 (0.14–11.12)
Physical abuse	Yes	5.52 (2.46–12.41)****	3.24 (1.32–7.97)**	3.24 (1.32–7.98)**	3.37 (1.37–8.33)**
Emotional abuse	Yes	5.03 (2.25–11.22)****	3.32 (1.39–7.92)**	3.33 (1.39–7.94)**	3.28 (1.37–7.85)**
Neglect	Yes	5.11 (2.17–12.02)****	3.45 (1.39–8.78)**	3.52 (1.39–8.86)**	3.43 (1.43–8.24)**
Sexual +/- physical abuse	Yes	4.61 (2.08–10.23)****	2.84 (1.18–6.83)*	2.84 (1.18–6.83)*	1.30 (0.41–4.23)
Emotional abuse +/- neglect	Yes	4.84 (2.42–9.67)****	3.41 (1.61–7.19)***	3.43 (1.62–7.26)***	2.93 (1.07–7.93)*

[a]Any childhood maltreatment included one or more combination of neglect, sexual, physical or emotional abuse.

Model 1. Unadjusted childhood maltreatment and delinquency.

Model 2. Model 1 + adjusted for maternal age at pregnancy, maternal education at pregnancy, same partner as birth of a child and 14 years, paternal or maternal racial origin at pregnancy, youth education at 21 years and residential problem area at 21-years.

Model 3. Adjusted for Model 2 + maternal ever arrest for any offenses over the first 5 years and parental supervision at 5 years.

Model 4. Adjusted for Models 1 + 2 + 3 + any substantiated maltreatment excluding the variable of interest so as to avoid overlap.

*$p < 0.05$; **$p < 0.01$; ***$p < 0.001$; ****$p < 0.0001$.

Table 4. Progressive bivariate and multivariable logistic regression associations between each substantiated child maltreatment category and delinquency in females (n = 2008) at 21-year, Brisbane, Australia.

Childhood maltreatment	Category	Unadjusted OR (95% CI)	Adjusted OR (95% CI)		
		Model 1	Model 2	Model 3	Model 4
Any maltreatment	No	1	1	1	1
Any maltreatment[a]	Yes	0.56 (0.14–2.31)	0.57 (0.13–2.42)	0.56 (0.13–2.41)	-
Sexual abuse	Yes	0.61 (0.08–4.50)	0.77 (0.09–5.98)	0.76 (0.09–5.97)	0.74 (0.09–5.80)
Physical abuse	Yes	0.68 (0.09–4.89)	0.57 (0.08–4.33)	0.57 (0.08–4.32)	0.56 (0.07–4.25)
Emotional abuse	Yes	0.55 (0.07–4.01)	0.54 (0.07–4.09)	0.54 (0.07–4.08)	0.54 (0.07–4.04)
Neglect	Yes	1.45 (0.34–6.11)	1.44 (0.32–6.42)	1.44 (0.32–6.42)	1.37 (0.31–6.11)
Sexual +/- physical abuse	Yes	0.72 (0.17–2.99)	0.71 (0.16–3.05)	0.70 (0.16–3.05)	0.61 (0.09–3.87)
Emotional abuse +/-neglect	Yes	0.89 (0.22–3.74)	0.93 (0.22–3.99)	0.93 (0.21–3.99)	1.26 (0.19–8.01)

[a]Any childhood maltreatment included one or more combination of neglect, sexual, physical or emotional abuse.

Model 1. Unadjusted childhood maltreatment and delinquency.

Model 2. Model 1 + adjusted for maternal age at pregnancy, maternal education at pregnancy, same partner as birth of a child and 14 years, paternal or maternal racial origin at pregnancy, youth education at 21 years and residential problem area at 21-years.

Model 3. Adjusted for Model 2 + maternal ever arrest for any offenses over the first 5 years and parental supervision at 5 years.

Model 4. Adjusted for Models 1 + 2 + 3 + any substantiated maltreatment excluding the variable of interest so as to avoid overlap.

Table 5. Progressive bivariate and multivariable logistic regression associations of frequency of child maltreatment substantiations and delinquency at 21-year, Brisbane, Australia.

Frequency of maltreatment	Unadjusted OR (95% CI)	Adjusted OR (95% CI)	
	Model 1	Model 2	Model 3
Males			
Frequency of substantiations			
Only once	1	1	1
Two or more times	2.21 (1.42–3.46)***	1.74 (1.07–2.83)*	1.74 (1.07–2.84)*
Females			
Frequency of substantiations			
Only once	1	1	1
Two or more times	0.87 (0.39–1.97)	0.89 (0.39–2.08)	0.89 (0.39–2.08)

Model 1. Unadjusted frequency of substantiations to childhood maltreatment and delinquency.

Model 2. Model 1 + adjusted for maternal age at pregnancy, maternal education at pregnancy, same partner as birth of a child and 14 years, paternal or maternal racial origin at pregnancy, youth education at 21 years and residential problem area at 21-years.

Model 3. Adjusted for Model 2 + maternal ever arrest for any offenses over the first 5 years and parental supervision at 5 years.

*$p < 0.05$; ***$p < 0.001$.

Discussion

Youth delinquency is a global public problem (69) and is associated with childhood maltreatment regardless of social and developmental disadvantages at individual, family and environment levels. There is, however, a significant knowledge gap about the extent to which differential and co-occurring childhood maltreatment predicts delinquency, controlling for potential confounders at different levels and by gender. The present study aims to address three questions in regard to childhood maltreatment and its consequences for later delinquency in youth. These included the associations of specific and multiple forms of childhood maltreatment, frequency of substantiation to maltreatment and delinquency, as well as gender differences in subsequent delinquent behaviour in maltreated individuals.

We found significant and strong associations between all forms of childhood maltreatment and delinquency for males, but not for females. Sexual abuse was the exception, and did not predict delinquency in either gender. Multiple forms of childhood maltreatment including sexual with or without physical abuse, and emotional abuse with or without neglect were also associated with delinquency in males although the former was moderated when adjusted for overlapping emotional abuse with or without neglect. Similarly, a higher frequency of maltreatment substantiations predicted later delinquency above and beyond confounders in males but not in females.

Some limitations should also be considered when interpreting the findings. Inconsistent definitions (70) and substantiation of childhood maltreatment have been associated with underreported or undetected cases (54), and these may have contributed for the observed weak associations by underestimating the actual rates, especially in females and sexual abuse. Specific characteristics of childhood maltreatment experiences including age or types of perpetrator(s) were not included in the analyses, though they are suggested to contribute to poor mental health including dissociation (71), which, in turn, is associated with delinquency (72). The present study was concerned with self-reported delinquency in general, and did not consider specific delinquent behaviours such as substance use disorders and aggression. Finally, this study could not adjust for genetic characteristics (73) that may interact with childhood maltreatment in predicting developmental timing of maltreatment, antisocial behaviour and its chronicity (55).

Although the rate of substantiated childhood maltreatment is higher in females, delinquency outcomes appeared to be specific for maltreated males rather than females. These differences may be attributable to different underlying factors including less exposure to delinquent peers, or strong social bonds and greater parental supervision in females (21) as opposed to more exposure to delinquent older siblings (22) and less protection in males (23). It has also been suggested that females may manifest other forms of antisocial behaviours, for example, running away (74), and

tend to respond to their victimisation with internalising rather than externalising symptoms (31). It is suggested that exposure to the same childhood maltreatment including physical abuse may manifest through property, felony and violent offenses in males (31). Delinquency items used in the current study such as *destroying things belonging to others, breaking rules at work* and *hanging around with others who get into trouble* may be more relevant to male delinquency.

Gender differences in underlying contextual factors (21) pertaining to psychosocial (23) and biological differences (21) such as developmental problems (26) in maltreated males and females (27) may also manifest through differing patterns of psychopathology (28) including aggression (72) and delinquency. These factors may affect respective responses (29) and adaptations (28) to maltreatment (30) suggesting the observed gender differences. For example, males who disclose their sexual abuse victimisation have been found to be more likely to receive negative reactions (75), while females have been observed to receive supportive feedback when maltreated (76). These differences in responses may increase the risk of delinquency (8, 77) in males. Although the current study could not adjust for genetic variation and mental health problems, these factors may also explain gender differences in later delinquency for maltreated children. For instance, a recent meta-analysis revealed that a monoamine oxidase A gene interacts with exposure to childhood maltreatment and parenting and sociodemographic hardships to strongly predict antisocial and aggressive behaviours in males rather than females (73), possibly suggesting differences in the structure and function of the brain (78).

However, these findings are not universal with other researchers reporting mixed results on gender differences. For instance, in some studies childhood maltreatment has been associated with delinquency in males rather than females (16, 59, 79), while in others it has been associated with delinquency in females but not in males (58). The reasons for this discrepancy in findings are unclear. One reason might be the way that childhood maltreatment is measured. This study used substantiated cases of childhood maltreatment that antedated the reports of delinquency, as well as clinical cutoffs for the delinquency scale. Other studies have used retrospective reports of childhood maltreatment and court recorded or self-reported delinquency using arbitrary cutoffs. Another reason for the variation in findings might be the individual, familial and environmental variables that were controlled for in this study, but not in others.

To our knowledge, this is the first investigation between prospectively substantiated differential and co-occurring types of childhood maltreatment including frequency of substantiation, and the risk of delinquency using clinical criteria in youth, with a large birth cohort study design and controlling for a range of relevant individual, parental and environmental confounders. The model that controlled concurrent socioeconomic status including the neighbourhood characteristics of the

young adults may represent a conservative prediction of delinquency. Our findings may also have both empirical and clinical implications. Clinicians, community workers and decision-makers need to understand the potential long-term risks of childhood maltreatment on later delinquency, particularly for males. The adverse effects of childhood maltreatment on subsequent behaviour underscore the need for concerted public health and clinical interventions including the prevention of childhood maltreatment and screening for delinquency in maltreated individuals. Indeed, it has been suggested that home visits by nurses, especially in the first 5 years of age, may mitigate both childhood maltreatment (80) and the effect of childhood maltreatment on early onset antisocial behaviour (34). Further research as to why maltreated males are at higher risk of delinquency than their female counterparts is warranted to help target interventions.

Conclusions

Maltreated male children appear to have a higher risk of delinquent behaviour at early young adulthood, although it is also important to note that the majority of maltreated children do not experience later delinquency. Primary prevention of childhood maltreatment may reduce the risk of later delinquency, particularly for males. Further research as to why maltreated male children are substantially at greater risk of delinquency than their maltreated female counterparts is warranted. In addition, further information on factors that protect the majority of maltreated children from developing delinquency might inform future prevention.

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A meta-analysis of the association between childhood sexual abuse and risky sexual behaviours

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Objective: This meta-analysis examined the overall association of CSA and adulthood RSBs, reporting subgroup analyses by gender, study time, study quality score, and method of CSA measurement.

Abstract

This meta-analytic review examines the association between CSA and RSBs with subgroup analyses by gender. Systematic searches of electronic databases including MEDLINE, PubMed, EMBASE, and PsycINFO were performed using key terms. We used *a priori* criteria to include high quality studies and control for heterogeneities across eligible studies. The review was registered with PROSPERO and used the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines. The final meta-analysis applied fixed-effects model to generate pooled OR. Subgroup analyses were conducted to identify potential methodological moderators. The meta-analysis included 8 eligible studies (N = 38,989, females = 53.1%). The overall *syndemic* of RSBs at adulthood was 1.59 times more common in CSA victims. There was a similar association between CSA in general and subsequent RSBs in both females and males. However, in cases of substantiated CSA, there was a greater odds of RSBs in females (OR = 2.72) than males (OR = 1.69). The magnitude of association of CSA and RSBs was similar for males and females regardless of study time, study quality score and method of childhood sexual abuse measurement. There were nonsignificant overall and subgroup differences between males and females. Childhood sexual abuse is a significant risk factor for a *syndemic* of RSBs and the magnitude is similar both in females and males. More research is needed to explore possible mechanisms of association.

Keywords: childhood sexual abuse, risky sexual behaviour, *syndemic*, meta-analysis

Introduction

Population-based estimates show that the rates of both nonpenetrative and penetrative CSA (1) appear to be greater in females than males (2), disproportionately affecting those children with poor developmental and health outcomes. These include poor mental health, early initiation of substance use disorders (3), stressful familial and environmental situations (e.g., low bonding, poverty, familial illiteracy, substance use, DV, conflict and post conflict environments) (3-10). The nature of CSA including duration, frequency (11), use of force (12), type of abuse (i.e., penetrative versus nonpenetrative), relationship and context of a perpetrator (13) (e.g., father figures with substance use disorders (14)), and family environment (15) may also determine the severity of potential consequences. Long-term effects may vary by gender but the results are contradictory with some work suggesting it is more severe in females (15) while others suggest it is greater in males (11).

Likewise, RSBs are significant health problems that may lead to long-term poor reproductive health outcomes such as infertility (16), pelvic inflammatory diseases and sexually transmitted infections (STIs) including HIV (17). Biological, behavioural and environmental determinants including genetic factors (18), timing (19) and frequency of risky sexual activity, incorrect and inconsistent use of contraceptive (20), and MSPs (21) constitute RSBs. Moreover, a range of mental health problems involving depression (22), alcohol use (23), personality disorders (24) including aggression and antisocial behaviours (25), lack of family support (26) and poor parental monitoring (27) appear to be the correlates of RSBs.

Childhood sexual abuse and risky sexual behaviours

Childhood maltreatment in general, and CSA in particular, is associated with a range of RSBs and appear to lead to subsequent poor health outcomes, regardless of gender (28). For instance, early engagement in unprotected sex, sexual dysfunction (6), MSPs (29), casual sex and prostitution (30) are common in sexually abused males and females even after controlling for sociodemographic characteristics and a psychiatric disorder (29). These associations are doubled for sexually abused children (29). In prospective studies, males and females of prior CSA exhibit early sexual debut (31), unprotected sex (32), HIV risk behaviours (31) and other STIs after adjusting for sociodemographic characteristics (33), although these findings are not consistent (34).

Retrospective findings suggest an association between CSA and RSBs including MSPs in heterosexual men (35), but not in men who have sex with men (36). In females, after controlling for other forms of maltreatment (physical abuse, emotional abuse and neglect) (37), CSA is associated with unprotected sex, MSPs (38), sex trading (39) and unintended teenage pregnancy (40), both in clinical and community settings. In prospective studies, sexually abused females tend to report

higher rates of teenage pregnancy (41), teenage motherhood (42), preterm delivery (43), HIV risk (41) and other gynaecological problems (44). However, CSA does not appear to significantly predict STIs in female clinical samples (13). Moreover, sexually abused children may reflect different patterns of sexual orientations including heterosexual, bisexual, or lesbian as adults (45), and may have an increased vulnerability to subsequent RSBs.

A number of caveats are relevant to interpreting the findings of an association between CSA and RSBs. Most of the findings are from clinical samples (13, 30, 39), may not represent the general public (15, 46), thereby affecting the reliability and external validity of findings. Other issues include recall, rumination and help-seeking bias. Furthermore, social stigma, ideological and political sensitivities may be additional limitations.

To our knowledge, there has been no systematic review and meta-analysis of CSA and its relationship with a *syndemic* of RSBs in both males and females. The current meta-analysis aims to examine the overall association of CSA and adulthood RSBs and provides subgroup estimates by gender, study time, study quality score, and method of CSA measurement (self-report versus substantiated). We hypothesised that there would be an association between CSA and a *syndemic* of RSBs irrespective of gender.

Theoretical framework

There are a number of theoretical approaches that explain the mechanism linking CSA and RSBs. First, distorted behavioural responses to beliefs induced by poor self-esteem, lack of psychosocial wellbeing, avoidant coping strategies, low self-efficacy, belief in traditional gender roles, poor psychosexual functioning, and relationship difficulties may lead to risky behaviours (47). For instance, sexually abused children may exhibit sexualised behaviours in childhood (28) and consequently experience more RSBs later in life (48). Second, traumatic sexualisation, betrayal, guilt and powerlessness (39) may lead to RSBs. In fact, CSA has been associated with each of these dynamics (49-52) as well as disrupted *psychobiological* development (41). As a result, cognitive and affective responses to the outside world are negatively affected resulting in a distorted concept of self and others, and reduced awareness of protective behaviours such as contraceptive use. Third, CSA may lead to dissociative disorders (53) with distorted information processing for risky behaviours and diminished risk reduction behaviour. Finally, other simultaneous or sequential risky behavioural problems (48) including smoking (40), alcohol problems (35), drug use (54), exchanging sex for drugs (30), mental health problems (55), and other morbidities (56) in the maltreated may, in turn, related to RSBs. Importantly, victims of childhood adversity may react differently depending on factors such as genetic (18), personality (57), and environment including family and community dynamics (58) may contribute for the disparity in vulnerability. Moreover,

intact mental health status, high level of familial, and social functioning (29, 58) may buffer the negative effects of CSA on RSBs (29).

Models used to study childhood sexual abuse and risky sexual behaviours

A *syndemic* model commonly used in infectious disease literature represents the intricate interplay between various early life events (59) and later poor health outcomes that help understand the complex nature of childhood maltreatment, underlying factors, and long-term health impacts which may largely depend on *polyvictimisation* (60, 61). In particular, children with a history of CSA have greater rates of a range of physical and mental illness (62) suggesting the likelihood of *syndemic* among the victims of CSA (63). Indeed, the *differential* effects model postulates that specific types of childhood maltreatment are associated with specific types of health outcomes (64, 65). Nonetheless, much has remained unstudied (48) and there is little known about whether CSA is specifically associated with RSBs (63) taking gender into account (48). This meta-analysis therefore aims to compare the association between CSA and RSBs by gender.

Methods

Definitions

Childhood sexual abuse

The Centres for Disease Control and Prevention (CDC) defines CSA as "any completed or attempted (non-completed) sexual act, sexual contact with, or exploitation (i.e., noncontact sexual interaction) of a child by a caregiver" (66). However, the WHO uses a wider definition to include inducement or coercion of a child to engage in any unlawful sexual activity, as well as the exploitative use of a child in prostitution, other unlawful sexual practices or pornography (67). As a result, studies in this meta-analysis may have used subtly different operational definitions within the contexts of CDC and WHO definitions. There are two main methods used in measuring CSA: the first is retrospective self-report using validated tools such as Childhood Trauma Questionnaire (68) and the second is data obtained from the records of local child protection services (69). Seven studies included in this study used self-report (29, 33, 38, 70-73) and one used substantiated records of CSA (74).

Risky sexual behaviours

Risky sexual behaviours include an early age of sexual debut (75), practising unprotected sex, having sex with strangers or multiple partners (21), concurrent or sex after drinking alcohol (76) or using drugs (77), sexual or partner violence (78) and transactional sex (34). However, definitions vary from study to study. For instance, the cut-point at which early initiation of sexual intercourse is considered risky ranges from 13 to 15 year or younger (74). In addition, subcategories of early sexual debut (as < 16, 16–18 or > 18 years) have been used (33). Studies have also used

various schemes of timing. For example, this ranged from 6 (72) to 12 (33, 38, 71, 79) months for assessing number of sexual partners, 12 months for condom use (33, 38), treatment for STIs (38, 71) and lifetime history or specific diagnosis for STIs (80).

Search strategy

This review was registered with the PROSPERO, international database of prospectively registered systematic reviews (CRD42015027028) (81).We used systematic searches of electronic databases including PubMed, EMBASE, PsycINFO and Google Scholar to identify potential studies. The latter was used to manually search for reference lists of included articles. A Boolean search technique was established using exposure, outcomes and the combination of both exposure and outcomes identifier key terms. The exposure identifier key terms were—*child* OR childhood maltreatment OR child adversity OR child trauma OR childhood sexual abuse OR sex abuse*; outcome identifiers—*adolescent risky sexual behaviours OR adult risky sexual behaviours OR adolescent OR adult reproductive health outcomes*; and combined exposure and outcome identifiers—*child* OR childhood maltreatment OR child adversity OR child trauma OR childhood sexual abuse OR sex abuse AND adolescent OR adult sexual risk behaviours AND adolescent OR adult reproductive health outcomes*.

Screening and selection

We removed duplicates and used the PRISMA checklist (82) to assess relevance of the identified studies based on titles and abstracts.

Inclusion criteria

We included population-based (non-clinical) observational quantitative studies that controlled for potential confounders and reportedone or more RSBs related outcomes associated withCSA in adults of both genders. We restricted this study to those articles published from 1 January 1990 through 30 May 2016. This time frame was chosen because it coincided with heightened global awareness of childhood maltreatment and its potential consequences.

Exclusion criteria

Excluded studies were qualitativeor quantitative studies that used only descriptive statistics and included only male or female participants, or outcomes specific to one gender (e.g., pregnancy). Studies derived from clinical samples were also excluded. These were excluded on the basis that clinical samples may be at greater risk of rumination (12) and help-seeking bias, and may not reflect the associations of interest in the population (15, 46).

Data extraction and quality assessment

Data extraction followed the PRISMA guidelines. The primary author (AAA) developed the hypothesis and methodology and identified all potential studies. Two authors, AAA and JCM,

extracted all pertinent information and assessed the qualities of included studies. The extracted data include overall study descriptions, sample sizes, proportions, and adjusted ORs (calculated for CSA *victims* versus *control* participants) with 95% CIs for both males and females separately, and other main findings. Numerator and denominator data and beta coefficients and their standard errors (if given) were used to estimate ORs where ORs with 95% CIs were not provided. Efforts were made to contact the corresponding authors, whenever there was insufficient information to calculate the estimates. Quality was assessed based on study features using a ten-point Newcastle-Ottawa Scale for assessing the quality of observational studies (83) (Appendix 4). Quality scores were derived for our purposes and did not necessarily represent the original theme of each included research article. The overall agreement for quality score assessment was 75%. Disagreements in regard to quality assessment occurred for 25% (n = 2) of the studies due to some ambiguities about study designs and description of the data sources. These disagreements were resolved by discussions and mutual consensus between the two reviewers. Interrater reliability was assessed using kappa statistic for overall quality assessment score and other categorical variables and was generally high. Kappa was 0.93 (p = 0.002), 0.89 (p = 0.004), 0.83 (p = 0.001), 0.81 (p = 0.005) and 0.77 (p = 0.0006) for study country, year of publication, study design, CSA measurement and overall quality score, respectively, in both genders. Kappa values higher than 0.75 are taken to suggest excellent interrater agreement (84). Intraclass correlation (ICC) was computed for continuous variables and was generally high but different across genders. In males, ICC was 0.88 (range: 8–4944, median = 2106), 0.77 (range: -0.60–7.90, median = 1.33), 0.80 (range: -0.90–8.50, median = 0.95), and 0.83 (range: 0.40–35.10, median = 2.50) for sample size, ORs, lower and upper limits for ORs, respectively. Similarly, ICC was 0.75 (range: 83–6262, median = 2276), 0.93 (range: -0.70–7.40, median = 1.27), 0.90 (range: -0.90–2.40, median = 0.89) and 0.83 (range: -0.50–23.500, median = 1.74) for sample size, ORs, lower and upper limits for ORs, respectively, in females.

Data analysis

The final meta-analysis then was performed using STATA 13.1 for windows and followed five distinct steps. First, Ors of each included study with multiple outcomes on RSBs were pooled using the weighted average generated based on the total sample size to aggregate all possible effects from one study into one overall OR for each study (i.e., primary *syndemic* factor) by gender. This technique avoids violation of independence of observations that may result from aggregation of overlapping samples (85). Odds ratios were used given the majority of the studies were cross-sectional. Second, we used both random- and fixed-effects models to estimate pooled OR. The composite measure of RSBs (i.e., overall *syndemic* factor OR) was obtained by weighting studies based on the inverse of variance using both random- and fixed-effects models (86). The random-

effects model was selected to account for any remaining heterogeneity in the estimates across studies because these models account for both random variability and the variability in effects among the studies (87). However, given the small number of included studies, random-effects model tended to be biased as the between-studies variance cannot be reliably estimated (86). There were no significant differences between the findings regardless of the models used. Results were interpreted based on fixed-effects model that accounts for systematic error of each OR (85). Forest plots show the weighted mean estimates of log transformed fixed-effects ORs with 95% CIs. We reviewed forest plots of summary estimates of each study to determine whether we could identify the source of any heterogeneity between studies. Cochran's Q set at $p = 0.05$ and I^2 were used to measure overall and between group heterogeneities (88). Third, a series of subgroup analyses were conducted to estimate OR for RSBs by gender, study time, study quality and CSA measurements. These subgroup analyses were intended to handle heterogeneities (89). The term gender as used here describes the differences may broadly be socially driven (90), as 75% of the included studies except two (29, 33) have also used the term gender rather than sex. Fourth, Q difference for each moderator and overall were used to test for gender differences. Continuous variables (i.e., year of publication and quality score) were used in meta-regression to test whether overall Q remains stable after adjusting for all moderators. This involved weighting of the effect sizes while considering variance overall, within the subgroup and between subgroups (85), with multiplicity adjustment which reduces standard error to account for small studies. Finally, Egger's test was conducted to test for possible publication bias (85). Heterogeneity statistics (Q, I^2) should be interpreted carefully because of a relatively small number of included studies for the meta-analysis. This may be a consequence of low statistical power given the modest number of studies available.

Results

Description of studies

We identified a total of 178 studies, of which 22 full text articles were potentially eligible. Two full text eligible articles (34, 80) were excluded due to overlapping sample as inclusion of the same cohort in the meta-analysis may bias the findings on CSA and RSB. Twelve studies were removed because they did not report the outcomes separately by gender. Finally, 8 studies were included in the meta-analysis. All included studies report the association between CSA and RSBs in adults (18+ years) except one study that included earlier age of RSB (71). The majority, 62.5% (n = 5), of included studies were cross-sectional whereas 37.5% (n = 3) were prospective observational studies. Longitudinal studies assessed RSBs at one particular data point in adulthood and data from this point was used in the analysis. Majority of the studies, 62.5% (n = 5), were conducted in the USA. The total sample size was 38,989, of which 53.1% were females. The mean quality score was

5.88 (SD ± 1.5) and 5 articles scored below the mean. The PRISMA flow diagram was used to present the process of screening and selection of eligible studies (Figure 1).

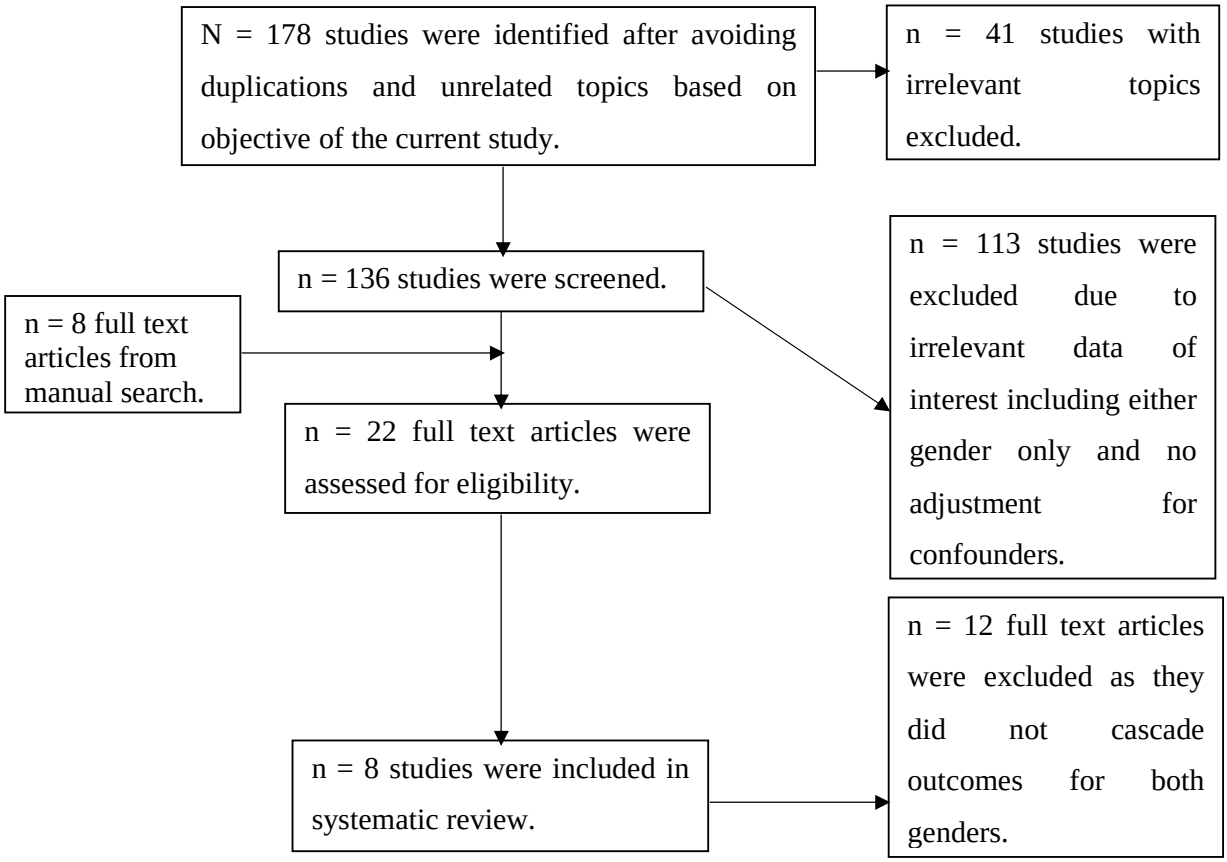


Figure 1. Schematic representation of studies included in the systematic review using PRISMA checklist and flow-diagram.

Markers of RSBs included the following: early age at first sex (29, 74), risks of previous vaginal sex (29, 72), unprotected anal sex (38, 71), more than one sex partner for last 6 months (29, 33, 72), number of lifetime sexual partner (29, 72, 73), inconsistent condom use (29, 38, 71-73), sex with strangers (73), promiscuity (74), prostitution (73), heavy drinking before sex (71), previous year (38) and lifetime use of concurrent intravenous drugs use (73) with unprotected sex (38) and sex with strangers (73), self-reported (33, 38) and test-identified STIs (33), HIV+ at test (38, 72) and disclosed results of HIV test to partner (72). Moreover, number of times involved in unintended pregnancy (for both genders) (71) and history of later sexual victimisation and perpetration (70) were also included. Detailed narrative synthesis that focussed on describing the overall characteristics of the eligible studies was presented in Appendix 4 (Table 12).

Main findings

Table 1 and Figure 1 show the meta-analysis outputs of the current study. Childhood sexual abuse was associated with a 1.59 times greater likelihood of RSBs. Results were similar for both

males and females regardless of time of study (year of publication). In females, these results persisted even when analyses were restricted to better quality studies. In subgroup analyses, the OR of a *syndemic* of RSBs for substantiated CSA cases was higher in females but not in males while in self-reported CSA, the likelihood of RSBs was equivalent in males and females (Table 2). There was evidence of significant heterogeneity of findings in all the main analyses. However, this was no longer significant when the studies are of better quality (Table 2).

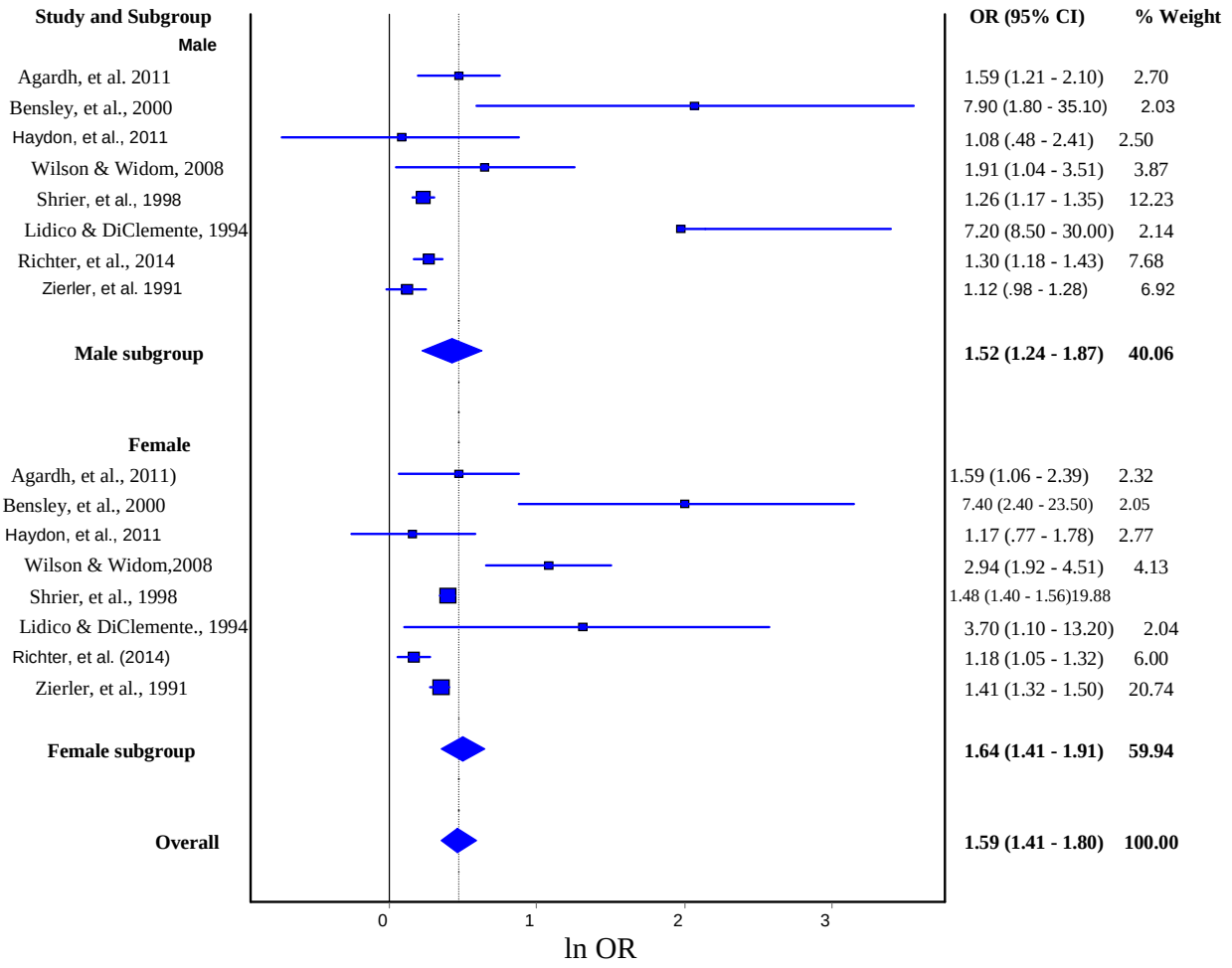
Analyses of Q differences across moderators revealed that none of the moderators significantly explained the heterogeneity in both genders except for CSA measurement among females during the subgroup analyses (Table 2). However, this is only a non-parametric test of difference between subgroups (*self-report* versus *substantiated records*). Overall Q difference was significant between the genders (Q = 11.21 (df = 1), $p < 0.001$) in univariate analyses. Finally, meta-regression using a continuous study quality score showed no significant differences for all moderators as well the overall Q with a meta-regression coefficient of 0.99 (95% CI: 0.50–1.95, $p = 0.978$).

Overall Egger's bias test did not reveal statistically significant publication bias for included studies (i.e., bias coefficient = 1.43, $p = 0.098$). Bias coefficient was 2.22 ($p = 0.82$) and 1.20 ($p = 0.313$) for males and females, respectively. Homogeneous Q statistics also suggested that there were few differences among the included studies.

Table 1. Fixed-effects OR of the association between CSA and *syndemic* of RSBs by year of publication, study quality score and CSA measurement.

		Male			Female		
Subgroup	***n***	**OR (95% CI)**	**Q, I^2**	**dQ (*p*-value)**	**OR (95% CI)**	**Q, I^2**	**dQ, (*p*-value)**
Year of publication							
Before 1999	3	1.25 (1.17–1.33)	32.27*, 83.7%		1.45 (1.39–1.51)	3.47*, 42.3%	4.55 (0.033)
After 1999	5	1.34 (1.23–1.47)	8.92*, 55.1%	1.75 (0.186)	1.29 (1.16–1.43)	26.8*, 85.1%	
Study quality							
Above mean	3	1.15 (1.00–1.30)	2.84, 29.7%	3.36 (0.067)	1.43 (1.34–1.52)	12.01*, 83.3%	0.00 (0.970)
Below mean	5	1.31 (1.24–1.38)	36.73*, 89.1%		1.45 (1.36–1.50)	22.87*, 82.5%	
CSA measurement							
Self-report	7	1.28 (1.21–1.34)	41.26*, 85.5%	1.68 (0.195)	1.42 (1.37–1.48)	23.80*, 74.8%	11.08 (0.001)
Substantiated records	1	1.69 (1.01–3.23)	-		2.72 (1.72–4.33)	-	
Overall pooled OR	8	1.52 (1.24–1.87)	48.93*, 84%		1.64 (1.41–1.91)	34.88*,79.9%	

n = number of studies; Q = Cochran Q; I^2 statistic = percentage of variation across studies attributable to heterogeneity; dQ = test of Q difference between subgroups; *p*-value = *p*-value for Q difference in each subgroup; *p-value Qs < 0.05.



ln OR = log transformed OR.

Figure 2. Fixed-effects OR of CSA and RSBs by gender.

Discussion

This meta-analysis included studies from both developing and developed countries undertaken in the last 25 years. This time frame was chosen because of the attention paid to childhood maltreatment and its potential consequences globally. Most participants in eligible studies were drawn from large, population-based cross-sectional and longitudinal studies that adjusted for sociodemographic disadvantage and other adversities.

Our results demonstrate the continued importance of CSA in predicting different forms of adulthood RSBs. In addition, the significant association between CSA and RSBs did not vary by gender. In females, this association persisted even when analyses were restricted to better quality studies. These findings are important given the public health impact of RSBs including STIs such as HIV. It is therefore important to screen for RSBs among survivors of CSA.

Interestingly, our findings show that substantiated CSA in females is associated with greater risk of RSBs than self-reported cases. This may suggest recall bias in cross-sectional designs

potentially underestimating the overall impact of self-reported cases. Although substantiated CSA cases may underestimate the magnitude of childhood maltreatment (69), substantiation may be more useful to explore the severity of later outcomes.

Strengths of this meta-analysis include the assessment of CSA on a cumulative score of a range of RSBs and limiting designs to well controlled available studies from developed and developing countries that met *a priori* criteria. The OR estimates used robust technique and both subgroup and overall analyses to explore the relationship of CSA and RSBs in terms of gender, study time, study quality, and type of CSA measurement (self-reported or substantiated). To our knowledge, this is the first study to assess the impact of CSA on a range of RSBs pooled to represent one RSB *syndemic* outcome (*syndemic* factor). Though conservative criteria were used initially to control for heterogeneities across included studies, subgroup and overall analyses explored statistically significant heterogeneities across included studies.

However, all included studies exclusively focussed on CSA and little is known about the effect of other types of childhood maltreatment on RSBs. While *polyvictimisation* to multiple forms of childhood adversities is common (91) and associated with poor outcomes than single forms of childhood maltreatment (92), the current study is limited to CSA and so excludes the negative effects of comorbid adversities on RSB. We were also unable to adjust for other mediating or coexisting factors including alcohol, smoking, violence and other mental and physical morbidities (55, 93), and family environment (11, 15) that may have inflated the observed association. Future research should focus on exploring the association between mutiple forms of childhood maltreatment and adulthood RSBs accounting for some of these other potential confounders.

In addition, these findings should be interpreted cautiously because of variation between studies in how both CSA and RSBs were defined. Furthermore, the majority of the studies were cross-sectional with the possibility of recall bias in self-reported CSA that could have either under- or over-estimated its occurrence. For instance, rumination bias (12) where a history of CSA may be linked to RSBs could inflate the observed associations in self-reported cases. Although, cross-sectional studies cannot definitely establish a causal relationship, CSA generally antedated most RSBs suggesting that CSA was a likely predictor of RSBs. In the case of substantiated records, the effect is generally to underestimate the actual magnitude of CSA and thus the association with RSBs. The use of relatively conservative inclusion criteria that limited the number of studies may also have underestimated the observed associations. The distribution of quality scores of individual studies was narrow and should be interpreted cautiously. Finally, insufficient numbers of studies reported limited the same individual outcome to be able to meta-analyse RSB outcomes separately.

Childhood sexual abuse is suggested to be a unique risk factor for later RSBs (37) with a wide range of potential mechanisms playing a role for associated long-term effects (94) such as risks for HIV (17), pelvic inflammatory disease (95), and infertility (16), with both public health and clinical implications (96, 97). These individuals thus should be screened and offered appropriate interventions. These may mainly include prevention of CSA through access to all-rounded sustainable interventions including raising public awareness, home visitations (96), family (98), and social (94) support backed by appropriate sexual and reproductive health education and services. Alternative and therapeutic centres that specifically address the victims (97) of both genders (99) with integrated interventions for concomitant underlying (100) *biopsychosocial* risk factors (96) along with screening for CSA (38), other co-occurring adversities, and subsequent outcomes may alleviate the problems. Finally, there is a need to understand more about the social context of childhood maltreatment as well as the dynamics that determine the practices (101) and subsequent adverse outcomes.

Conclusions

Overall, the findings of this meta-analysis indicate that CSA increases the risk of RSBs in both males and females although it is greater for females in cases of substantiated abuse. Risky sexual behaviours represent small subset of the adverse outcomes of CSA but are outcomes that are less commonly documented. More research is needed to better understand possible mechanisms of the association.

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Childhood maltreatment, risky sexual behaviours and youth pregnancy outcomes

Published manuscript (click here to access full length article) and cited as:

Abajobir AA, Kisely S, Williams G, Strathearn L, Najman JM. Risky sexual behaviours and pregnancy outcomes in young adulthood following substantiated childhood maltreatment: findings from a prospective birth cohort study. J Sex Res. 2018;55(1);106–19.

Objective: This study examined whether substantiated childhood maltreatment predictedan early age at sexual debut and subsequent MSPs in both genders as well as youth pregnancy, and whether maltreated young women with more pregnancies were more likely at higher risk of terminations or miscarriages.

Abstract

Childhood maltreatment is associated with a range of adverse mental and physical health outcomes, including increased rates of STIs later in life. However, the impact on RSBs and pregnancy outcomes has not been adequately studied. This is particularly true for physical and emotional abuse, and neglect. We examined associations between prospectively substantiated childhood maltreatment and reports of RSBs by males and females, as well as selected pregnancy outcomes in females. We followed up 3081 (45.7% female) participants from the MUSP, a prospective Australian birth cohort study. Using logistic regression, we examined the association between substantiated childhood maltreatment from birth to 14 years, and self-reported RSBs and youth pregnancy outcomes at the 21-year follow-up. In adjusted analyses, children who had experienced multiple childhood maltreatment exhibited more RSBs than their nonmaltreated counterparts. In specific models, those exposed to each form of childhood maltreatment, independent of co-occurring forms of childhood maltreatment, had an increased likelihood of RSBs, particularly an early sexual debut and, for females, youth pregnancy. Neglect was also associated with MSPs, and emotional abuse with higher rates of miscarriage. There was no difference between males and females in how different forms of childhood maltreatment predicted RSBs in young adulthood. All forms of substantiated childhood maltreatment, including multiple substantiations, were associated with RSB in both sexes as well as higher rates of youth pregnancy in females. Moreover, emotional abuse persistently predicted miscarriages in young adult females. Understanding the association between childhood maltreatment and RSBs and youth pregnancy outcomes may help suggest preventive strategies.

Keywords: childhood maltreatment, risky sexual behaviours, adverse pregnancy outcomes

Introduction

Childhood maltreatment includes sexual, physical and emotional abuse, as well as neglect (1). According to DSM-5 and ICD-11, CSA is a penetrative or nonpenetrative sexual act that provides sexual gratification to the perpetrator. Childhood physical abuse is a nonaccidental physical injury with a potential to induce significant fear, whereas childhood emotional abuse is a pattern of behaviour such as verbal abuse, intimidation or manipulation that may result in significant psychological harm to the victim. Similarly, childhood neglect is parents' or primary caregivers' failure to respond appropriately to a child's basic age-appropriate needs; thus increasing the risk of later physical or psychological adverse outcomes (2). Data on childhood maltreatment can be obtained in various ways, including self- and community-reports, medical practitioner assessments (2) and substantiations from a government welfare agency (3).

Childhood maltreatment is a global public health problem (4, 5) that is associated with a range of physical, mental and psychosocial outcomes, as well as substance use disorders and overall poor QoL (4, 6-10). Among physical health outcomes, HIV and STIs are common in maltreated children (6, 8, 11-21). Yet, prior evidence on RSBs, which is largely cross-sectional, is inconsistent. For example, one study (15) reported modestly weak or no association for an early sexual debut and MSPs, while another study (12) reported a consistent association. Moreover, little is known about the effect of childhood maltreatment in the longer term—particularly substantiated physical and emotional abuse, and neglect (22).

In cross-sectional studies, CSA has been associated with an early sexual debut (e.g., before 16 years) (15), unprotected anal sex (15, 21, 23-28) and inconsistent recent or lifetime condom use (20, 23, 25, 29, 30). Multiple sexual partners (15, 23, 24, 29, 31-33) and sex with a stranger (20) also appear to be more common in maltreated children.

In terms of subtypes, CSA is associated with a range of RSBs, such as unprotected sexual intercourse and MSPs—particularly in males, as well as a greater risk of adolescent pregnancy (34, 35). Similarly, neglect and sexual, physical or emotional abuse, singularly or in combination, have been associated with an early debut, unprotected sexand MSPs (15, 28, 30, 31, 33, 36-38). However, the findings for other outcomes, including unprotected sex, are less consistent with no significant associations reported (15).

Previous studies have been largely cross-sectional and based on self-reports of childhood maltreatment, which are prone to recall bias (22, 39) and make it difficult to infer causal relationships. In addition, the majority of previous findings were derived from selected clinical samples and did not include details of physical abuse, emotional abuse, or neglect, thus limiting generalisability (15, 20, 21, 23-31, 36, 40-44).

In a few of the available longitudinal studies, sexual, physical and emotional abuse, and neglect—as well as a cumulative score of substantiated and self-reported childhood maltreatment (17, 45, 46) were associated with an early sexual debut (12, 18, 19, 45-47). These studies reported higher rates of MSPs, inconsistent condom use, unprotected anal sex and combining alcohol use and sex (18, 19). A recent meta-analysis of both cross-sectional and longitudinal studies suggested that both male and female children who were sexually abused experienced a range of RSBs in adulthood (22).

Several studies have reported that youth with a history of sexual, physical and/or emotional abuse report lower rates of contraception use (15, 16, 43, 45, 48), and that this may lead to increased levels of unintended adolescent pregnancy and teenage parenthood. Moreover, childhood maltreatment has been associated with increased risk of miscarriage (49), preterm delivery and even fibroids or leiomyomas (15, 16, 43, 45, 48). Conversely, the evidence is limited in other areas such as the effects of emotional abuse on RSBs (12, 17-19, 45-47).

In addition, adults who were maltreated as children have higher rates of STIs secondary to RSBs and other lifestyle-related risk factors (24) that may lead to other poor pregnancy outcomes. For example, childhood maltreatment is associated with tobacco smoking, alcohol use (50) and nicotine use (51), which are also common risk factors for miscarriage (52-54). However, to our knowledge, none of the prior studies have investigated the independent relationship between substantiated subtypes of childhood maltreatment and youth miscarriage.

A range of risk factors have been noted for childhood maltreatment, RSBs and other sexual and reproductive health outcomes. Markers of family problems—such as teenage motherhood and familial poverty, including low income (55)—are common risk factors for childhood maltreatment and their consequences (15, 56-59). Though, familial social support reduces the likelihood of negative consequences by moderating the problems occurring in maltreated children (60). Furthermore, familial support may help to maintain healthy levels of mental and physical functioning or keep problems below a clinical level (61).

The effect of a person's gender is unclear. The majority of previous studies focussed on sexually abused females (20, 23, 32, 40, 41, 43, 44). Where studies have included both genders, findings for males and females varied (17). Females were more likely to have experienced physical abuse and neglect (17). In addition, females were more likely to be at risk of unprotected sexual intercourse (31) and STIs (17), although there were no differences between males and females engaging in other RSBs (22) or contracting STIs except for physical abuse and neglect, which placed females at higher risk (17). On the other hand, males were found to be more promiscuous and to be more likely to engage in early sexual contact than females (12). Other individual

sociodemographic characteristics may be similarly associated both with childhood maltreatment and RSBs. These include low SES (e.g., low level of education, unemployment, low income) and being single, divorced, widowed, separated or unmarried (15, 23, 24, 27, 44).

Childhood maltreatment also predicts mental health problems (25, 40, 44, 56, 62), which may lead to RSBs (31, 62). For example, adults who were maltreated as children were more likely to have internalising problems, major depression, dissociation, and problematic use of drugs, and alcohol (25, 40, 44, 56, 62), which, in turn, increase their risk of sexual dysfunction and RSBs such as unprotected sex (31, 44, 62). However, few studies have controlled for these familial and individual confounding or intermediate third variables (34). Not controlling for these variable, may affect the validity of findings by inflating the observed associations.

It is possible that RSBs and adverse pregnancy outcomes are bidirectional, with these outcomes sharing common risk factors. Few studies have examined the additive or specific effects of all forms of childhood maltreatment, and the extent to which they predict RSBs, as well as pregnancy outcomes (34, 45, 63). In particular, the effects of specific characteristics of childhood maltreatment—including substantiations and number of substantiations of maltreatment—on RSBs (34, 45, 63) are rarely examined (22). This is specifically the case for the few extant longitudinal studies that investigate adverse sexual outcomes for only some subtypes of maltreatment (17, 45, 46). For example, longitudinal studies with substantiated cases of childhood maltreatment typically failed to include the effect of other types of childhood maltreatment including physical abuse, neglect (45) and emotional abuse (12, 18). Conversely, prospective measurement of childhood maltreatment may comprehensively identify maltreatment cases (64). There is therefore a need to examine multiple and subtypes of substantiated childhood maltreatment gathered prospectively and a range of sexual and reproductive health outcomes after controlling for confounding and/or mediating variables (34, 63).

In our analyses, we used substantiated (3) sexual, physical and emotional abuse, and neglect (65) up to the age of 14 years. *Multitype* maltreatment models, comprising combinations of the types of childhood maltreatment (65, 66) as well as frequency of substantiations (67) were used to examine the association between overlapping multiple types of childhood maltreatment and the outcomes. Frequency of substantiations may suggest recurrent and ongoing exposure to childhood maltreatment and was treated as the indication of severity of childhood maltreatment (68, 69). Exposure to childhood maltreatment predated RSBs and pregnancy outcomes and, thus, helped to prospectively examine respective associations.

This study hadtwo main goals: first,to examine whether multiple and specific forms of substantiated childhood maltreatment predicted an early sexual debut and MSPs; second, to

examine the association between childhood maltreatment and the number of youth pregnancies, and whether, among maltreated young women, number of pregnancies was related to number of terminations and miscarriages. We hypothesised that all forms of childhood maltreatment, as well as specific forms of childhood maltreatment would place young people at an increased risk of RSBs, and females at increased risk of pregnancy, termination of pregnancy or miscarriage. Furthermore, the hypothesised associations would not be moderated by the participant's gender, their background (mother's age at pregnancy, early childhood maternal social support and family income and prematurity at birth), concurrent sociodemographic disadvantage or their behaviour as an adolescent and adult (e.g., internalising problems, alcohol use and cigarette smoking). Finally, we tested whether the interaction between gender and substantiated childhood maltreatment experiences affected the outcomesof early onset for sexual intercourse and MSPs.

Methods

Participant characteristics andsampling procedures

The MUSP is a prospective Australian study of 8556 pregnant women initially invited to participate in the study. Pregnant women were recruited consecutively during their FCV at one of two Brisbane Metropolitan MMMH from 1981–84. A total of 7223 mothers gave birth to a live, singleton baby at the hospital, who was not adopted out prior to leaving the hospital. Mother-child dyads were assessed at 3–5 days postpartum and mothers were followed up again when the child was 6 months, and 5, 14 and 21 years of age (70). When the offspring were 21 years old (i.e., in 2001–04), they were invited to participate in an interview. Of the 3778 offspring who were interviewed, 3769 (99.8%) responded to questions about RSBs. Among these, 3297 participants (86.5%) reported having had sexual intercourse, and 1291 participants (34.3%) reported having had MSPs. We excluded participants who reported no sexual intercourse or no MSPs in the previous 12 months, so that our findings would not be biased by participants who wrongly reported no intercourse or no MSPs. This left 3081 participants with a mean age of 20.6 years (range: 19–22 years), and 45.7% female. In addition, only female participants of the cohort who had provided information about pregnancy outcomes were included (n = 1980). We confidentially linked all of the participants' data up to the 14-year follow-up with cases of childhood maltreatment, substantiated by the government DFYCCQ, and found that 511 participants (7.1%) experienced substantiated childhood maltreatment.

Measures

Substantiated childhood maltreatment

The DFYCCQ is responsible for verifying mandatory reports of childhood maltreatment notifications received from medical practitioners and members of the community. Notified cases are then investigated and may be substantiated by the department.

Substantiation of childhood maltreatment occurs when there is "reasonable cause to believe that the child had been, was being, or was likely to be abused or neglected." For this study, substantiated childhood maltreatment occurred when a notified case was confirmed for: (1) sexual abuse: "exposing a child to, or involving a child in, inappropriate sexual activities;" (2) physical abuse: "any nonaccidental physical injury inflicted by a person who had care of the child;" (3) emotional abuse: "any act resulting in a child's suffering any kind of emotional deprivation or trauma;" and (4) neglect: "failure to provide conditions that were essential for the healthy physical and emotional development of a child" encompassing both physical and emotional neglect (71). The department data included details of the number of times substantiations were recorded in the files up to the age of 18 years for a particular child.

Participants' sociodemographic characteristics and internalising behaviour

The analyses involved confounders from participants' early childhood through to their adulthood. Participants' gender and gestational age (*normal* or *premature*—less than 37 weeks (72)) were recorded at birth.

At the 14-year follow-up, maternal reports of the participants' internalising of problems over the previous six months was assessed using the CBCL (73). The internalising scale had 31 items ($\alpha = 0.88$), including somatisation, anxiety, depression and withdrawn behaviours. Each item had three responses: *0 = not true; 1 = somewhat or sometimes true; and 2 = very or often true*. Responses were summed up with a 10^{th} percentile cutoff, consistent with previously suggested research cutoffs (74). The CBCL is a widely used, and is a validated instrument for assessing symptoms of child psychopathology (75, 76).

Finally, participants' marital status (*never married* versus *ever married*, which included living together, separated, divorced or widowed) was collected at the 21-year follow-up and included in the models as a covariate.

Maternal/familial sociodemographic characteristics

Our study included reports by participants' mothers about maternal and/or family sociodemographic characteristics gathered at the initial interview when they were pregnant and up until the 5-year follow-up (1986–88). These included maternal age at pregnancy, family income and maternal social support. The participants' mothers age at their first obstetrical visit was classified as

20+ (reference) versus *13–19* years. Family income was measured from pregnancy through to the five-year follow-up, and the overall mean income was calculated. Those mothers whose income was consistently below the poverty line over the first five years of follow-up were coded as *consistent poverty* using the thresholds of the poverty level from 1981–83 (77). Further, maternal social network size was assessed at the 5-year follow-up using five items ($\alpha = 0.74$): the number of close friends/relatives, frequency and regularity of visits by relatives, and whether they participated in important decision-making or helped during serious health problems. Each of these items had six responses, ranging from one (more relatives) to six (none), with an overall score of 1–30. The five items were based on the Interview Schedule for Social Interaction (ISSI) (78), which was found to have a strong validity in other study samples (79). The items were combined into a single variable with scores ranging from 1–20 (adequate social support) and 21–30 (inadequate social support). Lower scores on this scale were taken to representan *adequate* social network.

Risky sexual behaviours

At the 21-year follow-up, participants reported their age at first coitus (in years) and indicated the number of sexual partners for the prior 12 months (none, 1–4, and 5 or more). Two dummy variables, *> 15 years* of age (reference) versus *≤ 15 years*, and *1 sexual partner only* (reference) versus *≥ 2* were created, respectively, for age at first sexual debut and number of sexual partners in keeping with other investigation (19). Female respondents were asked to report the number of times they experienced pregnancy, a termination of pregnancy and a miscarriage, using one survey item for each outcome. Responses were dichotomised as *never* (reference) versus *≥ 1*.

Alcohol and tobacco

Self-reported alcohol use and cigarette smoking were obtained at 21 years. Information on the amount of alcohol consumed was reported based on the estimated number of standard drinks. Thus, participants reported the frequency (never to daily drink) and amount (never drink to ≥ seven glasses in one session) of alcohol consumption. These variables were combined and recoded as *abstainer* versus *light to heavy drinker*, suggesting the continuum of alcohol use (80). Also, maltreated children exhibited similar alcohol use outcomes regardless of *light* versus *heavy* alcohol use (50). Similarly, information was obtained on the number of cigarettes smoked in the previous week (*non-smokers* versus *smokers of 1–20+ cigarettes*). These variables were included in the analyses as covariates for all models.

Data analyses

Chi-square analyses were performed to evaluate the relation of childhood maltreatment types to RSBs, defined as early sexual debut (*> 15* (reference) versus *≤ 15* years), having *two or more* MSPs (*one only* (reference)), as well as having one or more pregnancy, termination, and

miscarriage (*never* (reference) versus ≥ *1*). Exploratory chi-square analyses were also done to assess for gender differences in experiencing early sexual debut and MSPs. As males and females differed in whether they had MSPs, χ^2(df (1), n = 1268) = 60.1, $p < 0.0001$, we included gender–any childhood maltreatment interaction term in addition to the main effect of gender in subsequent analyses (see below). Although we ran a series of unadjusted logistic regression analyses, the findings were not presented throughout the document as they may be biased due to confounders (81).

A listwise deletion was used to conduct the analyses, excluding those participants with missing data at the 21-year interview. We used IPW analyses (82) from the complete cases to determine whether missing values affected the reliability of complete case findings. The MUSP cohort has different patterns and predictors of missing values, and the application of a technique that adjusts for missing values (e.g., IPW) has been recommended (83). That said, several variables were correlated with missing values, suggesting that data were not missing completely at random. Moreover, a substantial amount of data pertaining to childhood maltreatment were missing for each variable of interest, and weighting by using all available data is a preferable method instead of imputation (82). Unadjusted logistic regressions of the selected predictors of missing values were carried out to identify those variables associated with higher rates of missing values. Multivariable logistic regression analysis was then undertaken to determine the independent predictors of missing values and to generate weights for the study sample in regard to each outcome. Finally, the weighted sample that involved the final adjusted regression model was repeated to determine whether missing values had affected the findings for each outcome.

A series of multivariable logistic regressions determined the association between childhood maltreatment, including number of substantiations, and the outcomes measured at the 21-year follow-up, including early sexual debut and MSPs. Multiple models controlled for participants' gender, their mothers' age at pregnancy, family poverty and maternal social support in participants' childhood, participants' gestational age at birth, participants' internalising problems at 14 years, alcohol use, cigarette smoking, and participants' marital status at the 21-year follow-up. Selected confounders and/or covariates were entered hierarchically. First, we adjusted for confounders and one covariate (Block 1). Next, to examine the independent prediction of each subtype of childhood maltreatment, we added a composite variable of other forms of childhood maltreatment to determine whether particular abuse subtypes independently predicted outcomes. For example, when sexual abuse was the predictor, we added a composite variable, consisting of physical and emotional abuse, and neglect, into the model and so on. The independent prediction of other childhood maltreatment subtypes was tested in the same way (Block 2). Finally, we added gender–

any childhood maltreatment interaction term while testing males and females for the independent effect of childhood maltreatment on early sexual debut and having MSPs (Block 3). The final subsample was 3081 for both outcomes. The likelihood ratio for the final model was 16.7 ($p < 0.0001$) and 7.2 ($p = 0.007$) for early sexual debut and MSPs, respectively.

Following similar procedures, we analysed the number of times female participants (n = 1980) had ever been pregnant, and the number of times there was a pregnancy termination or miscarriage. The number of pregnancies was included in Block 1 as a covariate. We adjusted for the number of pregnancies in these models to control for the effect of more pregnancies on number of subsequent terminations and miscarriages. Blocks 1 and 2 analyses were repeated for the frequency of childhood maltreatment (*1* versus ≥ *2* episodes). The models pertaining to pregnancy outcomes in females did not include the interaction term. The likelihood ratio was 61.4 ($p < 0.0001$), 10.4 ($p = 0.001$), 10.7 ($p < 0.0001$) for number of pregnancies, terminations and miscarriages, respectively. The maximum likelihood ratio was used to test for model fit. Odds ratios with 95% CIs, at a 0.05 statistical significance level, were estimated in each model.

Results

At the 21-year follow-up, we had data for 3081 participants (45.7% female) on early experiences of substantiated childhood maltreatment and RSBs. Of these, 153 participants (5%) experienced substantiated childhood maltreatment including 49 (1.6%) experiencing sexual, 66 (2.1%) physical and 78 (2.5%) emotional abuse, and 65 (2.1%) neglect. Additionally, 415 participants (13.5%) reported an early sexual debut and 1268 participants (41.2%) reported MSPs. The mean age at first coitus was 14.1 (range = 7–21) years. A subsample of 1980 females reported on pregnancy outcomes: 519 (26.2%) experienced one or more pregnancies, of which 159 (8%) were terminated and 134 (8.8%) ended in a miscarriage. The denominator for the latter was 1525 women who reported whether they had experienced a pregnancy miscarriage.

The data revealed that a substantial portion of the cohort had missing values, particularly for any forms of substantiated childhood maltreatment (18.3%) at the 21-year follow-up. Data were rarely missing for other variables measured in earlier follow-ups. Analyses that included the weighted data using IPW did not reveal that missing data have affected findings from complete case analyses. Moreover, on unadjusted logistic regression analyses, missing values were associated with participant's mother's age at pregnancy, familial poverty over the first five years of a child's life, maternal social network at five years, being female and prematurity at birth, substantiations of all forms of childhood maltreatment and adolescence internalising problems. None of these variables were statistically significant predictors of missing values in multivariable analysis (Table not shown).

Childhood maltreatment was significantly associated with maternal age at pregnancy, χ^2(df (1), n = 3769) = 27.6, $p < 0.0001$, familial poverty, χ^2(df (1), n = 2935) = 8.5, $p = 0.004$, prematurity, χ^2(df (1), n = 3769) = 7.3, $p = 0.007$, adolescence internalising problems, χ^2(df (1), n = 3700) = 76.9, $p < 0.0001$ and alcohol useat 21-year follow-up, χ^2(df (1), n = 3461) = 63.3, $p < 0.0001$.

Baseline analyses did not reveal gender differences in these outcomes (Table not shown). At the 21-year follow-up, an early sexual debut was associated with younger age of participants'mothers at pregnancy, χ^2(df (1), n = 3561) = 4.2, $p = 0.041$, a poor maternal social network at 5 years, χ^2(df (1), n = 3241) = 27.62, $p < 0.0001$, childhood maltreatment, χ^2(df (1), n = 3081) = 62.9, $p < 0.0001$, internalising problems during adolescence, χ^2(df (1), n = 3316) = 39.5, $p < 0.0001$, alcohol use, χ^2(df (1), n = 3351) = 43.2, $p < 0.0001$, cigarette smoking, χ^2(df (1), n = 3127) = 37.1, $p < 0.0001$ and unmarried status, χ^2(df (1), n = 3453) = 14.3, $p = 0.001$. Similar pattern of association was observed for those who experienced MSPs. Likewise, participants at the 21-year follow-up who had teenage mothers at initial recruitment, had adolescence internalising problems, smoked cigarette and used alcohol experienced more pregnancies, terminations and miscarriages (Table not shown).

Childhood maltreatment in general, as well as specific subtypes of maltreatment involving sexual, physical and emotional abuse, and neglect was associated with an early sexual debut and MSPs in our sample of males and females. Higher rates of any type of childhood maltreatmen were observed for participants who initiated sex prior to age 15 years (25.5%) than for participants who had initiated sex after age 15 years (12.8%). This pattern was consistent across subtypes of maltreatment (Table 1).

These results remained significant after adjusting for all potential confounding variables and a covariate. These associations were independent of other forms of childhood maltreatment for each subtype of maltreatment. Neglect was significantly associated with MSPs in all models (Table 3). Recurrent substantiations for maltreatment were also significantly associated with early age at sexual debut (adjusted OR = 1.64 ($p < 0.0001$) (Table not shown). The gender–childhood maltreatment interaction term was significant ($p < 0.0001$) and therefore retained in the above models. The inclusion of an interaction term did not significantly change the findings in any of the models (Table not shown).

Among females, childhood maltreatment predicted higher rates of youth pregnancy, and greater risk for pregnancy termination and miscarriage. All forms of childhood maltreatment predicted a higher number of youth pregnancies. This trend was similar for pregnancy termination (except in the case of emotional abuse) and for miscarriage (Table 2). Those female participants

who had experienced any form of childhood maltreatment (i.e., sexual, physical and emotional abuse, as well as neglect) had higher rates of youth pregnancy in the adjusted models. However, none of the types of maltreatment reached significance level in predicting termination of pregnancy in the adjusted models, especially when adjusted for the number of pregnancies. Similarly, all forms of childhood maltreatment were associated with the number of miscarriages, although adjustment, particularly for the number of pregnancies, slightly attenuated these associations. Only emotional abuse was significantly associated with the number of miscarriages after adjusting for confounders and number of pregnancies (Table 4). The associations between more frequent episodes of childhood maltreatment substantiations and higher rates of pregnancies, terminations and miscarriages, were slightly attenuated when adjusted for all confounders (Table 5).

Table 1. Bivariate association between childhood maltreatment, early sexual debut and MSPs in males and female at 21-year follow-up (n = 3081)

Childhood maltreatment	**n**	**Early age at sexual debut**		**MSPs**	
		n (%)	**χ^2 (*p*-value)***	**n (%)**	**χ^2 (*p*-value)***
Any maltreatment	2928	376 (12.8)		1200 (41.0)	
No	153	39 (25.5)	19.96 (< 0.0001)	68 (44.4)	0.72 (0.396)
Yes					
Sexual abuse					
No	3031	403 (13.3)		1246 (41.1)	
Yes	49	12 (24.5)	5.18 (0.023)	22 (44.9)	0.29 (0.593)
Physical abuse					
No	3014	398 (13.2)		1238 (41.1)	
Yes	66	17 (25.8)	8.73 (0.003)	30 (45.5)	0.51 (0.475)
Emotional abuse					
No	3002	394 (13.1)		1200 (41.0)	
Yes	78	21 (26.9)	12.42 (< 0.0001)	68 (44.4)	0.72 (0.396)
Neglect					
No	3015	397 (13.2)		1232 (40.9)	
Yes	65	18 (27.7)	11.51 (0.001)	36 (55.4)	5.54 (0.019)
Number of substantiations**					
No	2927	376 (12.8)		1200 (41.0)	
1	97	22 (22.7)	21.12 (<0.0001)	42 (43.3)	

≥ 2	57	17 (29.8)		26 (45.6)	0.68 (0.711)

*χ^2 (df = 2); **χ^2 (df = 2).

Table 2. Bivariate association between childhood maltreatment of females and, youth pregnancy, pregnancy termination and miscarriage at 21-year follow-up (n = 1980)

Childhood maltreatment	Youth pregnancy (n = 519)			Termination of pregnancy (n = 159)			Pregnancy miscarriage (n = 134)		
	n	n (%)	χ^2 (*p*-value)*	n	n (%)	χ^2 (*p*-value)*	n	n (%)	χ^2 (*p*-value)*
Any maltreatment									
No	1888	460 (24.4)		1470	146 (9.9)		1467	118 (8.0)	
Yes	92	59 (64.1)	71.72 (< 0.0001)	79	18 (22.8)	13.08 (< 0.0001)	77	18 (23.4)	21.41 (< 0.0001)
Sexual abuse									
No	1938	492 (25.4)		1512	155 (10.3)		1508	129 (8.6)	
Yes	42	27 (64.3)	32.16 (< 0.0001)	37	9 (24.3)	7.56 (0.006)	36	7 (19.4)	5.19 (0.023)
Physical abuse									
No	1941	494 (25.5)		1519	157 (10.3)		1515	126 (8.3)	
Yes	39	25 (64.1)	29.53 (< 0.0001)	30	7 (23.3)	5.25 (0.022)	29	10 (34.5)	24.25 (< 0.0001)
Emotional abuse									
No	1933	492 (25.5)		1512	159 (10.5)		1508	126 (8.4)	
Yes	47	27 (57.4)	24.28 (< 0.0001)	37	5 (13.5)	0.34 (0.558)	36	10 (27.8)	16.51 (< 0.0001)
Neglect									
No	1943	493 (25.4)		1520	158 (10.4)		1515	127 (8.4)	
Yes	37	26 (70.3)	37.84 (< 0.0001)	29	6 (20.7)	3.19 (0.070)	29	9 (31.0)	18.18 (< 0.0001)
Number of substantiations**									
No	1888	460 (24.4)		1470	146 (9.9)		1467	118 (8.0)	

1	55	32 (58.2)		49	13 (26.5)	14.99 (0.001)	48	6 (12.5)	
≥ 2	37	27 (73.0)	74.23 (< 0.0001)	30	5 (16.7)		29	12 (41.4)	40.18 (< 0.0001)

*χ^2 (df = 2); **χ^2 (df = 2).

Note: Values for some cells may not add up to 1980 due to missing values.

Table 3. Adjusted logistic regression estimates of the association between childhood maltreatment, early sexual debut and MSPs in males and females at 21-year follow-up

Childhood maltreatment	Category	Early sexual debut		Multiple sexual partners	
		Adjusted OR (95% CI)		Adjusted OR (95% CI)	
		Block 1	Block 2	Block 1	Block 2
Any maltreatment	No	1	1	1	1
Any maltreatment[a]	Yes	2.07 (1.39–3.05)****	-	1.37 (0.97–1.95)	-
Sexual abuse	Yes	2.02 (1.03–3.96)*	1.99 (1.01–3.90)*	1.81 (0.98–3.36)	1.82 (0.98–3.37)
Physical abuse	Yes	2.21 (1.25–3.92)**	2.03 (1.14–3.62)**	1.39 (0.82–2.37)	1.41 (0.83–2.41)
Emotional abuse	Yes	2.38 (1.42–4.01)***	2.15 (1.27–3.65)**	1.44 (0.88–2.37)	1.45 (0.89–2.37)
Neglect	Yes	2.43 (1.38–4.26)**	2.29 (1.30–4.03)**	2.14 (1.25–3.67)**	2.16 (1.26–3.71)**

[a]Any childhood maltreatment included one or more combination of neglect, sexual, physical or emotional abuse.

Block 1. Childhood maltreatment + mother's age at pregnancy, family poverty over the first 5 years of child's life, maternal social support at 5 years, sex and gestational age at birth, internalising problems at 14-year, alcohol use, cigarette smoking, and marital status at 21-year.

Block 2. Adjusted for Block1 and any substantiated childhood maltreatment excluding the variable of interest so as to avoid overlap.

*$p < 0.05$; **$p < 0.01$; ***$p < 0.001$; ****$p < 0.0001$.

Table 4. Adjusted logistic regression estimates of the association between childhood maltreatment of females and, youth pregnancy, miscarriage and termination at 21-year follow-up

Childhood maltreatment	Cate-gory	Youth pregnancy		Termination of pregnancy		Pregnancy miscarriage	
		Adjusted OR (95% CI)		Adjusted OR (95% CI)		Adjusted OR (95% CI)	
		Block 1	Block 2	Block 1[b]	Block 2	Block 1[b]	Block 2
Any maltreatment	No	1	1	1	1	1	1
Any maltreatment[a]	Yes	4.27 (2.56–7.11)****	-	0.86 (0.43–1.73)	-	1.45 (0.74–2.72)	-
Sexual abuse	Yes	3.71 (1.84–7.49)****	3.47 (1.67–7.19)***	0.89 (0.31–2.54)	0.91 (0.39–2.53)	1.23 (0.47–3.24)	1.24 (0.47–3.24)
Physical abuse	Yes	5.57 (2.57–12.10)****	5.90 (2.72–12.83)****	0.84 (0.31–2.29)	0.97 (0.37–2.55)	2.12 (0.84–5.35)	1.11 (0.63–1.96)
Emotional abuse	Yes	3.29 (1.68–6.44)***	3.28 (1.60–6.72)***	0.59 (0.19–1.77)	0.66 (0.23–1.92)	2.74 (1.07–7.03)*	2.73 (1.07–6.92)*
Neglect	Yes	6.77 (2.90–15.79)****	7.17 (3.03–16.99)****	0.63 (0.22–1.82)	0.75 (0.27–2.09)	2.08 (0.82–5.29)	2.09 (0.83–5.26)

[a]Any childhood maltreatment included one or more combination of neglect, sexual, physical or emotional abuse.

[b]Adjusted for number of pregnancies at 21-year in addition to variables in Block 1.

Block 1. Childhood maltreatment + mother's age at pregnancy, family poverty over the first 5 years of child's life, maternal social support at 5 years, sex and gestational age at birth, internalising problems at 14-year, alcohol use, cigarette smoking, and marital status at 21-year.

Block 2. Adjusted for Blocks1 and any substantiated childhood maltreatment excluding the variable of interest so as to avoid overlap.

$^{*}p < 0.05$; $^{**}p < 0.01$; $^{***}p < 0.001$; $^{****}p < 0.0001$.

Table 5. Adjusted logistic regression estimates of the association between number of childhood maltreatment substantiations of females and, youth pregnancy, miscarriage and termination at 21-year follow-up

Frequency of maltreatment	**Number of youth pregnancy**	**Termination of pregnancies**	**Miscarriages**
	Adjusted OR (95% CI)[a]	**Adjusted OR (95% CI)**[a, b]	**Adjusted OR (95% CI)**[a, b]
Number of substantiations			
Once only	1	1	1
Two or more times	2.97 (2.07–4.25)****	0.84 (0.53–1.34)	1.49 (0.98–2.25)

[a]Adjusted for mother's age at pregnancy, family poverty over the first 5 years of child's life, maternal social support at 5 years, sex and gestational age at birth, internalising problems at 14 year, alcohol use, cigarette smoking, and marital status at 21-year.

[b]Adjusted for number of pregnancies at 21-year in addition to other variables included the models.

$^{**}p < 0.01$; $^{****}p < 0.0001$.

Discussion

Our longitudinal study examined the association between substantiated childhood maltreatment and self-reported RSBs, as well as pregnancy outcomes in young adulthood, using a population-based birth cohort sample. Young male and female adults who experienced childhood maltreatment by age 14 years were more likely to have had sexual intercourse before 15 years of age. The association between sexual, physical and emotional abuse, and neglect and early age at sexual intercourse was independent after adjusting for factors that might have plausibly confounded or mediated the relationship, as well as co-occurring forms of childhood maltreatment. Importantly, neglect persistently predicted MSPs in both genders. Moreover, multiple substantiated incidents of childhood maltreatment significantly predicted an early sexual debut. However, the effect of childhood maltreatment, including all subtypes, on the number of terminations and miscarriages was largely the function of higher rates of youth pregnancy in maltreated children—apart from emotional abuse where there was an independent association with miscarriages.

These significant findings for sexual debut at an early age, and higher rates of youth pregnancies and miscarriages remained despite adjusting for variables relating to the participants' mother and their early childhood, the participants' internalising problems during adolescence, and adulthood alcohol use and cigarette smoking. As well, a gender–childhood maltreatment interaction term was not found to moderate the association for early age of coitus. The current findings therefore provide strong evidence of the links of multiple and independent specific forms of substantiated childhood maltreatment and RSBs and youth pregnancy outcomes. Use of prospectively substantiated cases of childhood maltreatment has been demonstrated to provide less biased findings than retrospective self-reports of these experiences (84).

There are a number of possible explanations for these associations. For example, early onset sexual intercourse in the maltreated may occur because of underlying psychopathologies, including externalising problems in both genders (41). Furthermore, the effect of childhood maltreatment on later RSBs and sexual and reproductive health sequelae may be explained by traumatic sexualisation, and feelings of betrayal, guilt and powerlessness (63, 85). These consequences of childhood maltreatment may lead to RSBs such as unprotected sex, MSPs or sex trading (15), possibly by mediating the relationship between childhood maltreatment and MSPs (27). As a result, cognitive and affective responses to outside cues may be negatively affected, leading to a distorted concept of self and others (86), and reduced awareness of protective behaviours such as contraceptive use.

Furthermore, childhood maltreatment may lead to an insecure attachment that then contributes to RSB (87). Consistent with this is our finding that neglect was the only type of

maltreatment independently associated with MSPs, suggesting a compensatory effort to obtain intimacy. That is, neglectful parents who fail to attend and monitor their children (2) may have children who are more likely to exhibit inappropriate social norms and behaviours (88, 89), including risky behaviours during adolescence or adulthood. Moreover, other simultaneous or sequential risky behaviours (34) including exchanging sex for drugs (26), and susceptibility to other morbidities (24) may lead to RSB. These lifestyle factors may disrupt information processing and increase susceptibility to further risky behaviour. Finally, maltreated children may have higher rates of sexual preoccupation (45, 59)—such as frequent masturbation, pornography consumption, intrusive sexual thoughts, a preoccupation with sexual themes or fantasies (59) and risky romantic relationships (18)—that may lead to more sexual stimulation and engagement in RSBs (90), particularly an early sexual debut.

It is possible that adverse pregnancy outcomes may be a subset of RSBs and/or the intertwined effects of childhood maltreatmentand these risky behaviours. For example, an early sexual debut resulting from childhood maltreatment may lead to MSPs and exposure to STIs, resulting in higher rates of unintended youth pregnancies, terminations and miscarriages. Additionally, insecure attachment (56, 87, 91) and intrafamilial perpetration (20) may compromise interpersonal intimacy and increase vulnerability to RSBs with adverse reproductive health consequences.

Although studies examining the association between childhood maltreatment and miscarriage are in their infancy, a number of potential risk factors may play a role in the association. For example, those children with some form of congenital malformations are more likely to be maltreated (92, 93) and usually experience undesirable pregnancy outcomes, including miscarriages and preterm deliveries (94). Lifestyle-related risk factors, including cocaine use, are associated with childhood maltreatment (51) and may also be a risk factor for miscarriage (52). Future research controlling for these factors may benefit the field.

A number of limitations relevant to the findings of this study should also be considered. First, we were unable to consider any genetic contribution to observed differences in RSB (95), and this may have affected the findings. Second, we cannot be sure if some of the adverse outcomes such as higher rates of pregnancies and miscarriages may have been the direct consequences of childhood maltreatment orthe outcomes of risky behaviours. Third, we did not take into account the effect of sexual orientation on sexual behaviour, and this may have moderated the association for risky behaviours (96). Fourth, although our study controlled for alcohol use and cigarette smoking by participantsat the 21-year follow-up, for females who became pregnant, we were unable to adjust for these factors at the date of conception and at early pregnancy (97, 98), where they may have had

the greatest effect on the risk of miscarriage. Fifth, we could not identify possible medical causes of miscarriage (99) and participants may have experienced both a pregnancy termination(s) and a miscarriage(s). Thus, the two groups may not be mutually exclusive. Sixth, participants may have under-reported engaging in risky sex due to its perceived undesirability (100). Seventh, although we had data on such childhood maltreatment characteristics as duration and relationship to perpetrator, we could not carry out the analyses using these variables because of the small number of cases. Instead, we examined the extent of childhood maltreatment using the number of agency-substantiated events to examine each outcome—even though there may be variations between the research definitions (101) and legal definitions of childhood maltreatment (102, 103). Eighth, sample attrition in substantiated childhood maltreatment may have underestimated the actual levels of maltreatment and subsequent outcomes. Specifically, 358 participants (11.6%) with substantiated childhood maltreatment had missing values and were not included in the analyses. Further, substantiations and the consequent biases inherent in official reporting procedures (4, 84) may affect the findings, although health outcomes in general appear to be similar regardless of whether cases are self-reported or substantiated, particularly in sexual abuse (104). Ninth, dichotomising a continuous variable (e.g., age at sexual debut) may bias the findings due to loss of pertinent data (105), although our analyses found consistent findings across all models. Similarly, the relatively low alpha (0.74) of the maternal social support scale as per the ISSI may have modestly affected the reliability of this measure (79). Finally, carrying out a substantial number of analyses may have introduced a Type I error, although the patterns of results were similar, suggesting consistency of the observed findings.

The findings of this study have both preventive and therapeutic implications. These might include screening for childhood maltreatment at birth (106), positive parenting programmes such as Triple P (PPP: Positive Parenting Programme) (107), parent training (108), family social support (109) and home visits (108). In addition, people with a history of childhood maltreatment could have increased access to medical and reproductive health services (109), which may also include cognitive-based psychotherapy (108, 110). Finally, little is known about the effects of childhood maltreatment on the risk of later miscarriages, and further research to better understand the potential pathways is indicated.

In summary, all forms of substantiated childhood maltreatment, including multiple substantiations, were associated with RSB in both genders as well as higher rates of youth pregnancies in females. In addition, neglect was independently associated with MSPs and emotional abuse persistently predicted miscarriage(s) in young adult females. As hypothesised, a wider range of confounding variables including age of participants' mothers at pregnancy, internalising

problems during adolescence, and alcohol use and cigarette smoking in adulthood, did not moderate these associations. Interestingly, the interaction between the genders and substantiated childhood maltreatment experiences did not affect the outcomes for RSBs. Understanding the association between childhood maltreatment and RSBs and youth pregnancy outcomes may help suggest preventive strategies. Further research into the mechanism underpinning the association between childhood maltreatment and miscarriage is warranted.

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Chapter Five – Substance Use and Mental Health Disorders following Childhood Maltreatment

Childhood maltreatment and gender differences in injecting drug use

Published manuscript (click here to access full length article) and cited as:

Abajobir AA, Kisely S, Williams G, Clavarino A, Strathearn L, Najman JM. Gender-based differences in injecting drug use by young adults who experienced maltreatment in childhood: findings from an Australian birth cohort study. Drug Alcohol Depend. 2017;173:163–69.

Objective: This study determined a longitudinal association between substantiated childhood maltreatment and IDU while exploring gender differences in these associations.

Supplementary analyses: Data pertaining to data collection, study sample and exclusions, predictors of attrition, adjusted association between confounders and IDU by gender, and association between unsubstantiated childhood maltreatment notification and IDU by gender were published online and available at: http://dx.doi.org/10.1016/j.drugalcdep.2016.12.027.

Abstract

Childhood maltreatment has been associated with a range of adverse mental and psychosocial outcomes, but its association with subsequent IDU is less clear. This study investigates the associations between specific and multiple forms of substantiated childhood maltreatment and IDU reported at 21 years. The MUSP is a prospective birth cohort study. It recruited pregnant women at their FCV and collected data on their children at 21 years. Data from 3750 participants (1769 males and 1981 females) were analysed using agency-substantiated childhood maltreatment from birth to 14 years of age and self-reports of ever IDU at 21 years. We used multivariable logistic regression analyses to control for possible confounders. Some 4.1% (n = 72) of males and 4.6% (n = 91) of females had experienced substantiated childhood maltreatment. The prevalence of IDU was 6.6% (n = 118) and 4.6% (n = 91) for males and females, respectively. In adjusted models, all forms of substantiated childhood maltreatment, with the exception of sexual abuse, were associated with IDU in females (adjusted ORs = 2.69–3.02) but only emotional abuse (adjusted OR = 2.51) was associated with IDU in males. Multiply occurring forms of childhood maltreatment were also associated with IDU in females (adjusted ORs = 2.36–3.41) but not in males.

Conclusions: Injecting drug use appears to be an adverse outcome of childhood maltreatment particularly in females. Additional research is needed to better understand why females appear to be more affected than males.

Keywords: childhood maltreatment, injecting drug use, young adults, birth cohort

Introduction

Childhood maltreatment has an association with a range of adverse mental and psychosocial outcomes over a person's life course. Sexual, physical and emotional abuse, and neglect, or multiple types of maltreatment (1) have been linked to low self-esteem (1), depression, anxiety (1-8), suicidal ideations and/or attempts (3, 9, 10). Similarly, childhood maltreatment may lead to delinquent behaviour (11, 12) or externalising problems (7, 8) often involving problematic substance use (13, 14). Exposure to childhood maltreatment has also been associated with impaired cognitive development (15), a range of physical health disorders (16) as well as poor adherence to medications (13). However, there has been little explicit research on the association between childhood maltreatment and IDU (17).

There is some evidence that childhood maltreatment may lead to IDU. This body of evidence, largely from cross-sectional studies, suggests that sexual and physical abuse, and neglect may be associated with IDU (13, 14, 18-20). For instance, children exposed to sexual and physical abuse have been found to be earlier and persistent injecting drug users (14, 19). However, these studies tend to rely on the self-reported recall of childhood maltreatment. By contrast, sexual and emotional abuse, and neglect have not been associated with IDU in high risk youth (18). In addition, the vast majority of these cross-sectional studies have focussed on the effects of either sexual or physical abuse rather than emotional abuse and neglect.

Two longitudinal studies found that sexual abuse predicted the initiation of IDU, with nearly one in ten abused youth injecting drugs at a 2.71 times greater rate than the nonmaltreated group (21, 22). However, these studies did not consider the effects of other possible concurrent types of childhood maltreatment.

The association between childhood maltreatment and IDU may also vary by gender. For example, longitudinal studies have shown that females are more likely to experience sexual abuse (14, 23), with many females experiencing multiple forms of maltreatment (23, 24) whereas males experience physical abuse (23). In cross-sectional studies, there is also evidence of gender differences in the experience of specific (13, 25-27) and multiple (20) forms of childhood maltreatment in injecting drug users. That means, females are at a greater risk of IDU (19). However, such a gender effect may be modified by other confounders or covariates (19), with a number of studies reporting no gender differences in the association between childhood maltreatment and IDU (14, 18, 21). These include younger age (14, 22), poverty including homelessness (22), parental substance use and accompanying poor mental health (18, 28).

The current evidence is inconclusive and largely based on retrospective data which may be prone to report, selection, help-seeking and rumination bias (13, 14, 18-20). Studies have also not

examined the association between different types of substantiated childhood maltreatment (i.e., sexual, physical and emotional abuse, and neglect (both physical and emotional)) and the extent to which they are associated with the IDU in young adulthood while adjusting for potential confounders. Substantiation of childhood maltreatment refers to the independent confirmation by child protection services that a child has been exposed to maltreatment by a caregiver before the age of 18 (29).

This study therefore uses a prospective longitudinal study design to determine the association between substantiated childhood maltreatment and IDU. We specifically addressed two questions: (1) to what extent are different and co-occurring forms of substantiated childhood maltreatment (0–14 years) associated with IDU in young adulthood (at 21 years)? and (2) are there gender differences in these associations?

Methods

Study participants

The MUSP is a prospective pre-birth cohort study of a sample of all women presenting at the MMMH for their first obstetric visit in Brisbane, Australia from 1981–83. A total of 8556 mothers were initially approached and 8458 accepted the invitation to participate. Of these women, 7223 gave birth to a live, singleton baby at the study hospital (30, 31). The current study consists of offspring with and without records of agency-substantiated cases of childhood maltreatment (ages 0–14 years) who reported on whether they had ever engaged in the injection of illicit drugs by the age of 21 years. The sample was restricted to 1769 and 1981 young males and females, respectively, for whom there were complete data (Online Supplementary Figure 1).

Substantiated childhood maltreatment

Notified cases of childhood maltreatment (including physical, sexual and emotional abuse, and neglect) 0–14 years of age were identified from state-wide child protection records. Notifications of childhood maltreatment come from mandatory reports by medical practitioners and referrals from the general public that were screened and investigated by FYCCQ. Substantiated cases of childhood maltreatment were those that were confirmed by FYCCQ because of "reasonable cause to believe that the child had been, was being, or was likely to be abused or neglected." The definition of sexual abuse included "exposing a child to, or involving a child in, inappropriate sexual activities." Physical abuse was defined as "any nonaccidental physical injury inflicted by a person who had care of the child." Emotional abuse included "any act resulting in a child's suffering any kind of emotional deprivation or trauma". Finally, childhood neglect was defined as a "failure to provide conditions that were essential for the healthy physical and emotional development of a child." Childhood experiences of *neglect* were intended to incorporate both

physical and emotional neglect by those who were taking care of a child (32). Data were anonymously linked to the MUSP longitudinal database in September 2000. Details are presented elsewhere (29). Children in the current study cohort often experienced multiple forms of maltreatment (33). As a result, the present study used hierarchical categories of substantiated childhood maltreatment (i.e., sexual, physical, emotional abuse, and neglect) (34). We used a *multi-type* childhood maltreatment model (34, 35) to examine the associations between co-occurring multiple types of childhood maltreatment and the outcome. In this model, we created six distinct categories of the childhood maltreatment to examine their possible association with IDU. This classification of childhood maltreatment is closer to the reality of the experiences of children who have been maltreated in multiple ways and helps assess the cumulative effects and severity of overlapping types of childhood maltreatment. Those children who had substantiated records of childhood maltreatment are grouped as *cases* and *not any maltreatment* was used as the reference group.

Injecting drug use

We asked respondents about whether they had ever injected illicit drugs at the 21-year follow-up interview. A binary (n*o/yes*) variable was created. Single items such as this binary variable have been usedto assess IDU in previous childhood maltreatment studies (13, 18, 21), and their predictive validity has been consistent.

Confounders and covariates

Maternal alcohol use and chronic depressive symptoms

Frequency and amount of maternal alcohol consumption at 3–6 months postpartum was assessed using two questions asking how often they consumed alcohol (never drink/daily/a few times a week/a few times a month/a few times a year/rarely) and how much alcohol they usually consumed at those times (never drink/less than one glass/one or two glasses/three or four glasses/five or six glasses/seven or more glasses) based on standard estimates of drinks. Because baseline analyses showed no difference between the different levels of maternal alcohol use with respect to childhood maltreatment and injection drug use, this variable was dichotomised into *abstainers* (reference group) versus *drinkers* (light-to-very heavy drinkers). Data on depressive symptoms experienced by mothers were obtained at pregnancy, 3–5 days and 6 months postpartum by using the two seven-item (α = 0.79, 0.81 and 0.83, respectively) subscales of the DSSI (36). The mean number of symptoms for the three follow-up periods was calculated. Women with 3 or more symptoms were classified as having had *chronic depressive symptoms*.

Sociodemographic characteristics in young adulthood

We included four dichotomised sociodemographic variables on whether young adults were receiving social security benefits (no*/yes*), their educational level (*incomplete secondary/secondary+*), marital status at 21 years (*ever married/never married*), and paternal or maternal racial origin (*White/Asian/Aboriginal-Torres Strait Islanders*) as recorded at their mother's FCV. The *ever married* group consisted of those living together and married, as well as separated, widowed and divorced.

Statistical analyses

We explored the bivariate association between different types of childhood maltreatment and variables of interest using chi-squared statistics. A series of binary logistic regression analyses was then carried out to examine the relationships between each single and co-occurring category of childhood maltreatment and IDU. We then developed a set of multivariable logistic regression models including each predictor, the outcome and selected confounders. We used Nagelkerke R^2 to test for model fit. The estimates of the unadjusted and adjusted ORs with 95% CIs of IDU in young adulthood were used to present the results with a reference level of *not any substantiated childhood maltreatment*. Since the likelihood ratio test determined that there were gender differences between males and females, a series of binary and multiple logistic regressions were carried out for males and females separately. These controlled for maternal alcohol use and chronic depressive symptoms, as well as participants' sociodemographic characteristics at the 21-year follow-up.

Sensitivity analyses

We examined the effect of expanding the definition of childhood maltreatment to any notified event rather than only substantiated cases.

Attrition

Binary and multivariable analyses of attrition were carried out to identify those variables associated with lost to follow-up. To account for attrition, we carried out weighted analysis using IPW (37). We then repeated the multivariable logistic regression analysis to determine weights for each variable involved in the study. Finally, we repeated the fully adjusted models with weighted variable to determine whether loss to follow-up changed the findings.

Results

A significant proportion of the participants was lost at the 21-year follow-up (Online Supplementary Figure 1). In multivariate analysis for attrition, only female gender predicted attrition (Online Supplementary Table 1). Adjusting for weighted data to account for attrition did not affect the strengths and directions of primary findings suggesting that the findings were unlikely to be affected by selection bias (Table not shown).

The vast majority of the sample were Caucasian (92.4%), followed by Aboriginal or Torres Strait Islanders (3.9%) and Asians (3.7%). Nearly three-quarters of the mothers (74.8%) reported consuming alcohol and 4.2% of mothers met the criteria for symptoms of depression postpartum. More than one-third (35.7%) of young adults were receiving social security benefits and 21% had incomplete secondary education, with the majority (78.2%) never having been married. Table 1 shows the distribution of these variables by gender.

Of the 1769 male and 1981 female participants at 21-year follow-up, 4.1% (n = 72) males and 4.6% (n = 91) females had experienced some form of substantiated maltreatment in childhood. The specific types included sexual (n = 53 or 1.4%), physical (n = 70 or 1.9%), emotional abuse (n = 86 or 2.3%), and neglect (n = 70 or 1.9%). There was no gender difference in experiencing any substantiated childhood maltreatment (p = 0.849), except for sexual abuse (p < 0.0001). Those males and females who reported receipt of social security benefits (p < 0.0001) and never married (p = 0.002) tended to more often experience any childhood maltreatment (Table not shown).

The overall prevalence of IDU was 6.6% (n = 118) and 4.6% (n = 91) for males and females, respectively. On bivariate analyses, males and females who had experienced any childhood maltreatment, physical and emotional abuse tended to experience higher rates of IDU than their nonmaltreated counterparts. For females, all forms of childhood maltreatment were associated with subsequent IDU. For males, any childhood maltreatment, as well as physical and emotional abuse were associated with IDU in unadjusted models (Table 2). There were also associations between receipt of social security benefits, never being married and IDU in both genders (Online Supplementary Table 2).

Table 3 present results for binary and multivariable logistic regression analyses. In males, any substantiated childhood maltreatment, physical and emotional abuse were significantly and strongly associated with IDU. The significant association persisted for emotional abuse and IDU in the fully adjusted model. Unlike emotional abuse, the associations of physical and emotional abuse and IDU were attenuated when adjusted for confounders. On subsequent analyses of co-occurring forms of childhood maltreatment, physical abuse with or without emotional abuse or neglect was associated with IDU in unadjusted analyses, although this was attenuated when adjusted for potential confounders.

In females, all types of substantiated childhood maltreatment were associated with the later IDU in binary models. The associations remained stable and robust after adjusting for selected confounders. However, the association between sexual abuse and IDU was attenuated in multivariable logistic regression models. In expanded models with multiple forms of maltreatment, any combinations of childhood maltreatment were associated with IDU in unadjusted analyses. The

association remained consistent for any combination of childhood maltreatment, physical abuse with or without emotional abuse or neglect, emotional abuse with or without any other combination, and neglect with or without any other combination of childhood maltreatment in fully adjusted models (Table 3).

Table 1. Distributions of confounders and/or covariates by gender, Brisbane, Australia.

Variables	**n**	**Males (n = 1769)**	**Females (n = 1981)**	**χ^2 (df = 1), *p*-value**
		%	**%**	
Maternal or paternal ethnicity at birth				
White	3394	92.3	92.5	1.21,
Aboriginal-Torres Strait Islander	142	4.0	3.4	0.546*
Asian	136	3.7	4.1	
Maternal alcohol use at postpartum				
Abstainers	889	24.3	25.0	0.24,
Drinkers	2742	75.7	75.0	0.623
Maternal chronic depressive symptoms				
No	3562	95.8	95.8	0.003,
Yes	157	4.2	4.2	0.955
Receipt of social security benefit at 21 years				
No	2398	72.7	56.7	103.4,
Yes	1332	27.3	43.3	< 0.0001
Education at 21 years				
Secondary and above	786	75.5	82.2	25.72,
Incomplete secondary	2964	24.5	17.8	< 0.0001
Marital status at 21 years				
Ever married	820	13.7	29.1	130.08,
Never married	2944	86.3	70.9	< 0.0001

*degree of freedom (df = 2).

In sensitivity analyses, any unsubstantiated notifications for childhood maltreatment were significantly and independently associated with IDU in respective models that adjusted for all confounders in both males and females. The magnitude and strength of association was higher in maltreated females than their maltreated male counterparts (Online Supplementary Table 3).

Table 2. Substantiated childhood maltreatment and IDU at the 21-year follow-up, Brisbane, Australia.

Childhood maltreatment	Males (n = 1769)			Females (n = 1981)			*p*-value[b]
	IDU, n (%)		χ^2 (df = 1)	IDU, n (%)		χ^2 (df = 1) (*p*-value)	
	No (%)	Yes (%)	(*p*-value)	No (%)	Yes (%)		
Any maltreatment[a]							
No	1590 (93.6)	108 (6.4)	6.29 (0.012)	1811 (95.8)	79 (4.2)	16.07 (< 0.0001)	< 0.0001
Yes	62 (85.1)	10 (13.9)		79 (85.8)	12 (13.2)		
Sexual abuse							
No	1641 (93.3)	117 (6.7)	0.10 (0.75)	1854 (95.6)	85 (4.4)	9.12 (0.002)	0.036
Yes	10 (90.9)	1 (9.1)		36 (85.7)	6 (14.3)		
Physical abuse							
No	1624 (93.3)	112 (6.7)	7.16 (0.007)	1859 (95.6)	85 (4.4)	11.62 (0.001)	< 0.0001
Yes	27 (81.8)	6 (18.2)		31 (83.8)	6 (16.2)		
Emotional abuse							
No	1618 (93.6)	111 (6.4)	7.71 (0.005)	1852 (95.7)	83 (4.3)	17.59 (< 0.0001)	< 0.0001
Yes	33 (81.5)	7 (17.5)		38 (82.6)	8 (17.4)		
Neglect							
No	1621 (93.4)	114 (6.6)	1.45 (0.23)	1860 (95.6)	85 (4.4)	12.19 (< 0.0001)	0.007
Yes	30 (88.2)	4 (11.8)		30 (82.3)	6 (16.7)		

[a]Any combination of childhood maltreatment included neglect, sexual, physical or emotional abuse.

[b]Likelihood ratio test of the interaction term with gender.

Table 3. Binary and multivariable logistic regression associations of single and multiple types of substantiated childhood maltreatment and IDU by males and females at 21-year follow-up, Brisbane, Australia.

Childhood maltreatment	Group	Males (n = 1769)		Females (n = 1981)	
		Crude OR	Adjusted OR[†]	Crude OR	Adjusted OR[†]
Single types					
No childhood maltreatment	No	1	1	1	1
Sexual abuse only	Yes	1.40 (0.18–11.05)	1.45 (0.18–11.96)	3.64 (1.49–8.86)**	2.41 (0.96–6.07)
Physical abuse only	Yes	3.22 (1.30–7.97)**	2.56 (0.99–6.58)	4.23 (1.72–10.42)**	2.69 (1.06–6.87)*
Emotional abuse only	Yes	3.09 (1.34–7.15)**	2.51 (1.05–5.98)*	4.69 (2.13–10.39)****	3.02 (1.30–6.97)**
Neglect only	Yes	1.89 (0.66–5.48)	1.43 (0.48–4.23)	4.38 (1.77–10.79)***	2.70 (1.05–6.93)*
Multiple forms					
Any combination of childhood maltreatment[a]	Yes	2.38 (1.18–4.76)**	2.01 (0.98–4.11)	3.48 (1.82–6.66)****	2.36 (1.19–4.67)*
Sexual abuse + any other combination[b]	Yes	4.69 (0.49–45.52)	3.33 (0.32–35.18)	3.99 (1.14–13-96)*	2.03 (0.56–7.45)
Physical abuse + emotional abuse or neglect	Yes	3.00 (1.12–8.01)**	2.22 (0.79–6.19)	5.17 (1.91–14.05)***	3.36 (1.17–9.63)*
Emotional abuse or neglect + any other combination[c]	Yes	2.60 (0.88–7.67)	1.97 (0.64–6.08)	4.23 (1.72–10.42)***	2.50 (0.96–6.49)
Emotional abuse + any other combination[d]	Yes	2.57 (0.97–6.77)	1.97 (0.72–5.40)	5.42 (2.43–12.11)****	3.33 (1.42–7.81)**
Neglect + any other combination[e]	Yes	3.05 (0.87–10.77)	2.18 (0.59–8.12)	5.73 (2.27–14.44)****	3.41 (1.29–8.97)*

[a]Any combination of childhood maltreatment included neglect, sexual, physical or emotional abuse. Any other combination refers to: [b]neglect, physical or emotional abuse; [c]sexual or physical abuse; [d]neglect, sexual or physical abuse; and [e]sexual, physical or emotional abuse; [†]adjusted for receiving social security benefits, educational level, marital status at 21 years and paternal or maternal racial origin at pregnancy, maternal alcohol use at 3–6 months and chronic depressive symptoms from pregnancy to 3–6 months postpartum; $^{*}p < 0.05$; $^{**}p < 0.01$; $^{***}p < 0.001$; $^{****}p < 0.0001$.

Discussion

There is strong evidence that suggests childhood maltreatment experiences are associated with subsequent gender-based IDU, particularly for maltreated females, despite some conflicting prior findings on whether maltreated males and females respond differently to this later outcome. In this study, exposure to any substantiated childhood maltreatment was associated with later IDU, especially in females. In particular, there were significant and strong associations between all forms of childhood maltreatment with the exception of sexual abuse. For males, somewhat surprisingly only emotional abuse was associated with later IDU, after adjustment for confounders. As suggested by our data and other prior studies (22), social deprivations in adulthood including the receipt of social security benefits and lower levels of education may also be associated with IDU in previously maltreated children, suggesting a continued impact of social disadvantage on later outcomes.

A number of psychosocial factors (38) may contribute to the observed gender disparity in IDU. For example, a dose-response relationship may account for the greater association between childhood maltreatment and IDU in females, given they may be more exposed to multiple forms of childhood maltreatment (35). Maltreated females may also be more vulnerable than males to poor mental health outcomes which later manifest as IDU (27). Males and females may also respond differently to their experiences of childhood maltreatment. In the case of males, the association may be through higher levels of antisocial behaviour (27), delinquency (27, 28, 33) and street crime (14). By contrast, the pathway for females may be through commercial sex (14, 38) or drug exchange (14), as well as having different sexual orientations (e.g., more likely self-identified as lesbian or bisexual) or using so-called *gateway* drugs (non-injecting drug including cannabis) (14). Moreover, females may have more exposure to a friend with IDU disorder (14), experience more violence victimisation from their proximal partner (27, 28) and have poorer relationship with parents, especially when parents also have a substance use disorder (27). However, the temporal sequence of some of these experiences is unclear and the exact mechanisms require further research. For instance, it is possible a non-traditional sexual identity could place someone at greater risk of childhood maltreatment resulting in stressors that later manifest with IDU as a coping mechanism in adulthood.

Sexual abuse was not associated with IDU in both genders in contrast to prior studies that have shown significant association with sexual abuse (21, 22). Potential reasons for this study's divergence from previous findings include variations between studies in how sexual abuse was defined (39), as well as the small number of sexual abuse cases in the present study, which, in turn, might have made it difficult to detect an association, even if one existed. In addition, when sexual

abuse is reported, it may be more likely that is stopped before victims progress to longer term adverse outcomes such as IDU (40). It is also possible that ongoing sexual abuse in adulthood may have more of an influence than childhood sexual abuse on concurrent IDU. Although it is beyond the scope of our study, the effect of exposure to multiple forms of childhood maltreatment may have a cumulative impact on the developing brain affecting both responses to stress (41) and cognitive function (42). This may, in turn, lead to more propensities of self-harm including injecting illicit drug.

To our knowledge, this is the first prospective investigation of the association between substantiated differential and co-occurring types of childhood maltreatment and the risk of IDU in young adulthood using a large birth cohort, with a focus on gender differences. The study determined the effects of each subtypes of maltreatment on IDU. As well, co-occurring childhood maltreatment models demonstrated the association between different combinations of maltreatment and subsequent IDU. The longitudinal nature of the study allowed us to assess the impact of childhood maltreatment on subsequent injecting behaviour by minimising the chance of recall and selection bias.

Our findings may have both empirical and research implications. Adult and paediatric healthcare providers need to understand the potential long-term risks of childhood maltreatment on later IDU, particularly for females. Neuroscience research is shedding light on neuroendocrine mechanisms through which early exposure to childhood maltreatment may lead to an increased risk for substance abuse. This may include changes in glucocorticoid stress response systems, oxytocin systems relating to social impairment, and dopamine-related reward sensitivity, each of which may differ based on gender (43). Maltreated individuals who inject drugs may also have multiple other risk factors including polysubstance use (13, 14), being victim and perpetrator of violence experiences (25) and HIV risk behaviours (13, 14, 26, 44), as well as poor adherence to medications (13) and perceived abuse in healthcare settings (45). Prevention of childhood maltreatment and trauma informed care (46) may provide a venue for intervening to reduce the long-term impacts of IDU in young adults. The latter involves understanding possible developmental pathways from childhood maltreatment victimisation to neurobiological impairments and subsequent substance use disorders (43). Also, the findings may help provide appropriate treatment for IDU among the maltreated people including social support (47) and cognitive-based psychotherapy (48, 49).

Limitations

Some limitations should also be considered when interpreting the findings. The use of substantiated childhood maltreatment may have contributed to the observed weak association with IDU, especially for sexual abuse and male participants by underestimating actual rates of

maltreatment. This is why we undertook sensitivity analyses of expanding the definition to include unsubstantiated childhood maltreatment where we found a similar association with IDU. Specific characteristics of childhood maltreatment experiences including age at the scene or types of perpetrator(s) were not included in the analyses although these may be relevant to understanding the findings (50, 51). Although childhood maltreatment is associated with an increased risk of IDU, there is a possibility of concomitant use of other drugs by maltreated children (22). Finally, the use of a single item to assess lifetime IDU may affect the validity of our findings, although prior studies have documented this outcome in maltreatment children (13, 18, 21).

Conclusions

In summary, IDU appears to be an adverse outcome of childhood maltreatment particularly in females. Additional research is needed to better understand why females appear to be more affected than males.

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Childhood maltreatment and cannabis use disorders

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Objective: This study examined the independent association between substantiated childhood maltreatment and cannabis use, abuse and dependence, as well as clinically subthreshold levels of cannabis use and an early age of onset of cannabis use, abuse and dependence disorders.

Supplementary analyses: Data pertaining to distribution of cannabis use disorders by study variables, adjusted standard coefficients of age of cannabis use, gender–any childhood maltreatment interaction term adjusted ORs for cannabis use disorders and predictors of attrition were published online and available at: http://dx.doi.org/10.1016/j.psychres.2017.06.017.

Abstract

This study investigates the association between exposure to prospectively-substantiated childhood maltreatment between 0 to 14 years of age and lifetime cannabis use, abuse and dependence reported at 21 years. Data were taken from 2526 (51.6% female) participants in the MUSP, a pre-birth, prospective, cohort study. Prospectively-substantiated cases of childhood maltreatment, reported to the government child protection agencies between 0 and 14 years of age, were linked to CIDI DSM-IV self-report data from the 21-year follow-up. Exposure to any childhood maltreatment, and childhood neglect in particular, predicted subsequent cannabis abuse with adjusted ORs of 1.79 and 2.62, respectively. Any childhood maltreatment, physical abuse, emotional abuse and neglect predicted cannabis dependence with adjusted ORs of 2.47, 2.81, 2.44 and 2.68, respectively. The associations for an early age of onset of cannabis abuse and dependence were significant and consistent for maltreated children. In addition, frequency of maltreatment substantiations predicted cannabis abuse, dependence and an early age of onset of these disorders. The adjusted ORs for cannabis ever use without any DSM-IV cannabis disorder were 1.78 for any maltreatment and 2.15 for emotional abuse. Any childhood maltreatment and neglect predicted lifetime ever cannabis use, as well as cannabis use disorder. There was little evidence for any interaction between gender and different forms of childhood maltreatment and its association with cannabis use disorders. Physical abuse, emotional abuse and neglect, as well as multiple episodes of maltreatment independently predicted cannabis use disorders.

Keywords: childhood abuse, neglect, cannabis use disorders, longitudinal study

Introduction

Childhood maltreatment including sexual, physical, emotional abuse and neglect (1) and substance use disorders, including cannabis abuse and dependence, are public health problems experienced by youth (2) in both developed (3) and developing (4) regions of the world (5). Although there is some evidence for an association between childhood maltreatment and adolescent cannabis use, little is known about the independent effects of specific forms of childhood maltreatment, particularly neglect, as well as the frequency or intensity of maltreatment.

There is emerging evidence, largely from retrospective studies of an association between childhood maltreatment and adolescent cannabis abuse or dependence, particularly when the maltreatment occurs at an early age (4, 6-9). For example, self-reported experiences of sexual abuse have been associated with higher rates of cannabis use in adolescents (4), with a twofold likelihood of cannabis abuse and dependence in sexually abused children, even after controlling for offspring gender, alcohol use disorders and conduct disorder (6). This association has also been observed in clinical patients with diagnosed mental health morbidities (7-9). Similarly, physical (7, 8) and emotional (9) abuse have been associated with cannabis use (7), abuse (9) and dependence (8) in patients aged between 12 and 29 years with mental health disorders (7) such as bipolar disorders (9) and schizophrenia (8). The temporal sequence and directionality of the association between experiences of maltreatment and cannabis use isuncertain because of the cross-sectional design of these studies. People with early cannabis use disorders may experience higher levels of maltreatment and may have higher rates of subsequent mental health disorders. More generally, previous studies have reported an inconsistent association both for physical (4) and emotional (4, 7) abuse, and have not considered childhood neglect as a potential predictor (4, 7, 9). Also life course impacts of adverse exposures can change overtime depending on resilience, recovery (10) and severity of the exposures, and may bias the findings, particularly in retrospective reports. In addition, the use of retrospective reports of childhood maltreatment limits the validity of the association between childhood maltreatment and cannabis abuse or dependence, including the age of onset of these disorders.

In a few prospective studies, sexual and physical abuse (11) predicted cannabis use (12, 13), abuse and/or dependence in adolescents (14), young adults (13) and adults (11). As well, a composite score of substantiated neglect, sexual, physical and emotional abuse (13, 14) predicted subsequent cannabis use disorders. The severity of childhood maltreatment (15) including frequency of maltreatment (16) may account for the relationship between childhood maltreatment and cannabis use disorders. However, these results are largely based upon unsubstantiated self-reports of childhood maltreatment. With one exception (13), previous studies have also not

addressed a range of types of childhood maltreatment, especially emotional abuse and neglect (12), although a few have included them in a cumulative score rather than independently (14). Consequently, little is known about the independent effect of different types of maltreatment (17) and the impact of the number of episodes on outcomes (18). In addition, the link between childhood maltreatment and an early onset of cannabis use disorders has not been well-established in a prospective population sample, controlling for the possible overlap between childhood maltreatment and the age of onset of cannabis use. The only report on this topic is for reported sexual and physical abuse (12, 19), as well as combined forms of substantiated maltreatment (12). None of these studies examined the independent effect of each form of substantiated childhood maltreatment, while adjusting for other concurrent forms of maltreatment (12).

The association between childhood maltreatment and cannabis use disorders may be complex, with a possibility that both may share common risk factors. For example, childhood maltreatment is commonly perpetrated by disadvantaged parents such as teenage mothers (20) who disproportionately experience prenatal and postnatal substance use disorders (21). In addition, gender (7), poverty (20, 22, 23), poor educational achievement (22) and being single/never married (24, 25) may also be associated with exposure to childhood maltreatment (7, 20-22, 26) as well as cannabis use disorders (23, 24, 27-29). However, few studies have controlled for these potential confounding factors and/or covariates. Furthermore, exposure to traumatic events and associated PTSD may be related to cannabis use disorders (12). For example, the association between PTSD and cannabis use disorders (i.e., lifetime, current and daily) is reportedly persistent even above and beyond the effects of sociodemographic characteristics, lifetime substance use disorders, concurrent mental health problems and lifetime traumatic events such as physical assault, combat experience and automobile accidents (12).

Another concern relates to cannabis use measurement. Abuse and dependence are separate categories in the DSM-IV (30) and ICD-10 (30). However, they are merged into a single diagnostic category in the 5th version of DSM (DSM-5) (30). Nonetheless, DSM-5 criteria may underestimate the prevalence of DSM-IV lifetime cannabis use disorders with 40% of cases with DSM-IV cannabis use disorders remaining undetected when assessed by using DSM-5 (30).

This study therefore examines the independent association between specific forms of substantiated childhood maltreatment and cannabis use as well as abuse or dependence, controlling for relevant confounders. It extends prior work using data from the same birth cohort on the effect of multiple combinations of childhood maltreatment on cannabis use (12). Unlike the earlier study, we specifically examined lifetime cannabis use, abuse and dependence separately, and adjusted for the effect of maternal smoking at pregnancy, as well as 6 months postpartum, on each form of

substantiated maltreatment, while adjusting for other concurrent types of childhood maltreatment. We specifically investigated the effect of maternal cigarette smoking during pregnancy because it is a risk factor for offspring neurobehavioural and cognitive disorders (e.g., ADHD, externalising, etc.) (31), psychotic symptoms (32), drug dependence (33), alcohol and cannabis use (34). In addition, the number of incidents of childhood maltreatment substantiations was used as a severity marker. Finally, unlike the earlier study by Mills et al.(13), this study also investigated the effects of increasing levels of cannabis use from subthreshold levels of cannabis use through to clinically evident disorders as measured by DSM-IV. We also investigated whether maltreatment had an effect on the age of onset of cannabis use disorders, and whether multiple episodes of child abuse and neglect predicted worse cannabis use, abuse and dependence outcomes.

Methods

Participants

The data of this study were collected from the MUSP, a cohort of expectant mothers and their children, identified consecutively at the time of their FCV from 1981–83 at Brisbane's MMMH. The number of mothers initially approached was 8556. Some 8458 pregnant women accepted the invitation to participate in the study. A total of 7223 gave birth to a live, singleton baby at the study hospital, who neither died nor was adopted out before the discharge. Starting from that point, the study focussed on mother-child pairs up to the 21 year offspring follow-up. There were follow-ups at 3–5 days and 6 months postpartum, as well as at 5, 14 and 21 years of the index child's age (35). The MUSP dataset was linked to agency-reported cases of childhood maltreatment of children 14 years of age and below. For the purpose of this study, the target age group is extended to the age of 21 years and their follow-up includes details of cannabis use disorders. The sample focussed on 2526 young adults (females = 51.6%), who had data on cannabis use disorders at the 21-year follow-up.

Measures

Childhood maltreatment

State-wide child protection records were used to identify suspected cases of childhood maltreatment. Referrals from community members and mandatory reports from general practitioners were sources of information for childhood maltreatment. This birth cohort (n = 7223), comprised 789 (11%) notifications of any childhood maltreatment, of which 663 were for abuse and 500 for neglect. Child protection data were not available for 9 participants. Those cases where the DFYCCQ had "reasonable cause to believe that the child had been, was being, or was likely to be abused or neglected" were defined as substantiated cases of childhood maltreatment. In terms of the categories of maltreatment, substantiated sexual abuse was recorded when the suspected child was

confirmed for, “exposing a child to, or involving a child in, inappropriate sexual activities.” Physical abuse was defined as “any nonaccidental physical injury inflicted by a person who had care of the child.” Emotional abuse included “any nonaccidental physical injury inflicted by a person who had care of the child.” Finally, neglect was defined as a “failure to provide conditions that were essential for the healthy physical and emotional development of a child”, including both physical and emotional neglect (36). Queensland government child protection agency workers determined substantiations of childhood maltreatment.

These data were confidentially and anonymously linked to the MUSP longitudinal database (37). In this study, substantiated cases of childhood maltreatment were restricted to those occurring between 0 and 14 years of age to ensure childhood maltreatment preceded cannabis use disorders. Child maltreatment events were dichotomised and coded as *substantiated maltreatment* versus *no maltreatment*. Specific categories (38) and co-occurring (39) forms of childhood maltreatment included substantiated sexual abuse, physical abuse, emotional abuse and neglect, as well as one or more combinations of the preceding maltreatment types. This classification appears to have greater predictive validity in predicting developmental outcomes (38, 39). To disentangle the specific effects of each form of maltreatment, a composite variable was created. For example, a variable that excluded substantiated sexual abuse was created from one or more combinations of physical abuse, emotional abuse and neglect to adjust for sexual abuse and so on. Each composite variable was used to adjust for a specific model that examined the association between each subtype of childhood maltreatment and cannabis use disorders accordingly. The study also investigated the effect of frequency of childhood maltreatment substantiationson later outcomes.

Cannabis use, abuse, dependence and age of onset of cannabis use disorders

The study assessed lifetime cannabis abuse (ICD-10: 305.2) and dependence (ICD-10: 304.3) of the participants using the CIDI-Auto Version 2.1 (40) at the 21-year follow-up. The age of onset of cannabis abuse (ICD-10: 305.2) or dependence (ICD-10: 304.3) was also recorded for those who reported either in their lifetime. Responses were coded to provide lifetime cannabis abuse and dependence based on the DSM-IV (30). The DSM-IV has been validated for cannabis abuse in a population-based adolescent sample (41) and these diagnoses are broadly compatible with the ICD-10 (42) and DSM-5 (21) classifications. Participants were considered to have cannabis abuse diagnosis, if they endorsed any one or more of the four DSM-IV cannabis abuse criteria. Similarly, they were considered to have the diagnosis of cannabis dependence, if they endorsed three of the seven symptoms for cannabis dependence. To test the association between childhood maltreatment and an early age of onset of cannabis abuse and dependence, we restricted the analyses to those who reported cannabis abuse and dependence, and stratified the participants by age when they first

reported cannabis abuse and dependence into the following categories; after and before 15 years of age. As there is no standard cutoff of age for early initiation of cannabis abuse, we chose the lowest fourth quartile of the age distribution to represent an early age of onset of cannabis abuse and dependence. In addition, participants were asked about the frequency of cannabis use in the previous month (never, every day, every few days, once or so, and not in the last month) and the age they started cannabis use (in years). The former was combined with DSM-IV disorders (i.e., abuse or dependence) to yield a categorical variable: *never used, ever used with no DSM-IV disorders* and *use with DSM-IV disorders*. This variable was used to examine whether childhood maltreatment predicted a greater tendency of episodic use or persistent cannabis use disorder. Additional models to test the temporal association between childhood maltreatment and cannabis use disorders by restricting the analyses to those who reported cannabis abuse and dependence were also performed. In addition, we assessed the effect of childhood maltreatment on age of onset of use as a continuous measure in participants who reported smoking cannabis (see the section on supplementary analyses).

Confounders/covariates

Both maternal and child related confounders/covariates were included in the analyses. Maternal age at pregnancy (in years) was obtained at FCV. This was dichotomised as *20+* versus *13–19 years* for logistic regressions and used as a continuous measure for the multiple regressions. We also included data on maternal prenatal and postnatal cigarette smoking, obtained at the FCV and 6 months postpartum. Mothers were asked how frequently they smoked cigarettes in the previous week at pregnancy and 6 months postpartum and recoded as follows: *no-smoker = 0; once or so = 1; every few days = 2; and every day = 3*. They were also asked how many cigarettes they smoked per day. The responses were recoded as follows: *nil = 0; 1–9 = 1; 10–19 = 2; 20–29 = 3; 30–49 = 4; and 50+ = 5*. A dichotomised composite variable for both prenatal and postpartum cigarette smoking was created from the frequency and number of cigarettes smoked and coded as *non-smokers* and *light to heavy smokers*. Family income was measured from pregnancy through to 5 years. The mean family income at each phase was taken and those mothers whose income was consistently below the poverty line over the first 5 years of their child's life were coded as *consistent poverty* versus *adequate income*, using thresholds of the poverty level from 1981–83 (43). Additionally, gender at birth (*male/female*), educational level attained (*complete post-secondary/incomplete post-secondary school*) and marital status (*married-living together-separated-divorced-widowed/never married*) were collected at the 21-year follow-up, and included in the analyses as covariates.

Statistical analysis

Descriptive statistics including chi-squared analyses were used to describe the study variables and bivariate correlations of the selected confounders/covariates, predictors and outcomes. A series of unadjusted and hierarchical multivariable logistic regressions were done specifying cannabis abuse, dependence, early age of onset of cannabis abuse and dependence as dependent variables. We chose hierarchical regression analyses to determine the predictive stability of childhood maltreatment with adjustment for potential confounders of different levels and overlapping forms of maltreatment. Each form of childhood maltreatment was sequentially entered into the first model (Model 1) followed by maternal (Model 2) and young adults' sociodemographic variables (Model 3) as well as the overlapping forms of childhood maltreatment variables (Model 4). Those who did not use or did not meet the DSM-IV cannabis abuse and/or dependence criteria were the reference groups in these models. We assessed the effect on severity of use with a three-category dependent variable ranging from never used through ever used but no disorder to abuse or dependence using unadjusted and simultaneously adjusted multinomial logistic regression models. The maximum likelihood ratio was used to test for model fit and significance. Additional analyses using the same models were done to account for possible overlap between exposure to childhood maltreatment and early onset cannabis abuse and dependence, controlling for those who reported cannabis abuse and dependence before the age of 14 years. The analyses were done for males and females separately, as well as the combined sample. Given that preliminary analyses showed gender differences in cannabis use disorders, interaction terms were computed for gender and all forms of childhood maltreatment and added to the final models. Odds ratios with 95% CIs were used to present the findings. A higher OR means a higher risk of cannabis use disorders.

Missing values

Weighted analyses using IPW (44) from the complete cases (45) were done to determine whether missing values affected the reliability of findings from complete cases in three steps. This approach is used to account for possible biases arising from higher rates of non-random missingness. Binary logistic regressions of the selected predictors, including gender, maternal age and cigarette smoking status, and family income against missing values were carried out to identify those variables associated with higher rates of missing values. These variables were also used to generate weights. Multivariable logistic regression analysis was then undertaken to determine the independent predictors of missing values and to generate weights for the study sample. Finally, the weighted sample that involved the final adjusted regression model was done to determine whether missing values had affected the findings for each outcome. Results presented in the main paper involved findings derived from both the unweighted and weighted data analyses.

Supplementary analyses

In order to examine the association between childhood maltreatment and age of onset of cannabis abuse, supplementary analyses using age of onset of cannabis abuse as a continuous outcome were carried out.

Results

There were 2526 participants who had complete data on lifetime cannabis abuse at the 21-year follow-up, representing 35% of the baseline cohort. Over 7 in 10 (n = 1834) participants ever used cannabis. Of these, 27.5% (n = 336) and 12.2% (n = 159) males and females were cannabis abusers, respectively. Similarly, 14.7% (n = 180) and 8% (n = 105) males and females had cannabis dependence disorder, respectively (Online Table S1). In the birth cohort, there were 789 notifications for any childhood maltreatment. This was substantiated for any maltreatment for 4.8% (n = 121) participants remaining in the study, of which 1.8% (n = 42) children experienced two or more episodes of childhood maltreatment substantiations. The rates of any substantiated childhood maltreatment were higher for teenage mothers (χ^2 = 27.62 (df = 1); $p < 0.0001$), maternal smoking both at pregnancy and postpartum (χ^2 = 26.65 (df = 1); $p < 0.0001$), family poverty over the first 5 years of age (χ^2 = 5.46 (df = 1); $p = 0.019$), incomplete high school (χ^2 = 4.23 (df = 1); $p = 0.040$) and being never married (χ^2 = 5.72 (df = 1); $p = 0.017$) at 21 years. The rates of late childhood and adolescence substantiations were higher for teenage mothers (χ^2 = 13.74 (df = 1); $p < 0.0001$), maternal smoking both at pregnancy and postpartum (χ^2 = 16.83 (df = 1); $p < 0.0001$) and family poverty over the first 5 years of age (χ^2 = 5.49 (df = 1); $p = 0.019$). The rates of more frequent substantiations were higher for teenage mothers (χ^2 = 28.02 (df = 2); $p < 0.0001$), maternal smoking both at pregnancy and postpartum (χ^2 = 26.12 (df = 2); $p < 0.0001$) and family poverty over the first 5 years of age (χ^2 = 16.78 (df = 2); $p = 0.019$).

The results are presented for cannabis abuse and cannabis dependence separately. A total of 19.6% (n = 495) participants met 1 or more of the DSM-IV diagnostic criteria for lifetime cannabis abuse at the 21-year follow-up. Of those who met a diagnosis of cannabis abuse, 34.5% (n = 171) had cannabis abuse symptoms before the age of 15. More than one half of those participants, 57.4% (n =284), who used cannabis also had cannabis dependence, meeting 3 or more of the DSM-IV diagnostic criteria. Interestingly, 29.4% (n = 743) participants used cannabis without manifesting any DSM-IV disorders. The age of onset of cannabis dependence was before 15 years for 25% (n = 72) of the participants. Maternal prenatal and postpartum cigarette smoking and incomplete post-high school at 21-year were more likely associated with later cannabis use disorders. Males had higher rates of cannabis abuse (χ^2 = 93.37 (df = 1); $p < 0.0001$), an early age of onset of cannabis abuse (χ^2 = 99.19 (df = 1); $p < 0.0001$) and cannabis dependence (χ^2 = 28.62 (df = 1); $p < 0.0001$).

Those participants who had had incomplete high school (χ^2 = 87.9 (df = 1); $p < 0.0001$) had higher rates of cannabis abuse. Levels of cannabis abuse and dependence were also higher for those who were exposed to any form of childhood maltreatment including physical abuse, emotional abuse and neglect, as well as for those substantiated for two or more episodes of substantiations to maltreatment (Table 1).

In binary logistic regression analyses, all forms of childhood maltreatment, except sexual abuse, were strongly associated with cannabis abuse (unadjusted OR = 1.95–2.91). Exposure to any childhood maltreatment was associated with 1.79 times the odds of cannabis abuse even after adjusting for sociodemographic variables. Similarly, after adjustment, neglect was strongly associated with higher odds of cannabis abuse (OR = 2.62) after adjusting for all variables and other forms of childhood maltreatment (Table 2). Any maltreatment, emotional abuse and neglect were associated with increased odds of an early age of onset of cannabis abuse in binary logistic regression models. After hierarchically adjusting for all confounders/covariates, childhood maltreatment (OR = 2.77), emotional abuse (OR = 3.59) and neglect (OR = 3.48) were strongly associated with an early age of onset of cannabis abuse (Table 3). All forms of childhood maltreatment, except sexual abuse, were associated with cannabis dependence in the binary logistic regressions. The statistical significance of any childhood maltreatment (OR = 2.47), physical abuse (OR = 2.81), emotional abuse (OR = 2.44) and neglect (OR = 2.68) remained stable after adjusting for all confounders/covariates and other forms of maltreatment in multivariable hierarchical logistic regressions (Table 4). Any types of maltreatment (OR = 3.72), physical abuse (OR = 5.09) and neglect (OR = 4.92) were associated with an early age of onset of cannabis dependence, after adjusting for all covariates/confounders and overlapping forms of childhood maltreatment (Table 5).

Further fully adjusted analyses using weighted data to account for possible selection bias did not affect the findings of complete case analyses. For example, the adjusted ORs of cannabis abuse were 1.80 and 2.63 for any childhood maltreatment and neglect, respectively. Likewise, the association between any maltreatment, physical abuse, emotional abuse and neglect, and cannabis dependence was consistent (Table 6).

In terms of frequency, more substantiated events were associated with higher odds of cannabis use disorders. Finally, fully adjusted analyses using weighted data also revealed similar findings with ORs of 1.52, 2.09, 1.88 and 2.71 for cannabis abuse, early age of onset of cannabis abuse, cannabis dependence and early age of onset of cannabis dependence, respectively (Table 7). Childhood maltreatment had a similar association with age of onset of cannabis use in participants who ever smoked cannabis (i.e., n = 1834), measured as a continuous variable (Online Table S2).

Table 1. Prevalence and bivariate association of childhood maltreatment and cannabis abuse and dependence at 21-year, Brisbane, Australia.

Childhood maltreatment	Cannabis abuse			Cannabis dependence		
	No; number (%)	Yes; number (%)	χ^2 (df = 1) (*p*-value)	No; number (%)	Yes; number (%)	χ^2 (df = 1) (*p*-value)
Any maltreatment[a]						
No	1946 (80.9)	459 (19.1)	8.32 (0.004)	2141 (89.3)	257 (10.7)	15.59 (< 0.0001)
Yes	85 (70.2)	36 (29.8)		94 (77.7)	27 (22.3)	
Sexual abuse						
No	1998 (80.3)	489 (19.7)	0.45 (0.504)	2208 (88.8)	278 (11.2)	0.68 (0.410)
Yes	33 (84.6)	6 (15.4)		33 (84.6)	6 (15.4)	
Physical abuse						
No	1997 (80.7)	478 (19.3)	6.23 (0.013)	2201 (89.0)	273 (11.0)	5.56 (0.018)
Yes	34 (66.7)	17 (33.3)		40 (78.4)	11 (21.6)	
Emotional abuse						
No	1991 (80.7)	476 (19.3)	6.09 (0.014)	2194 (89.0)	272 (11.0)	5.00 (0.025)
Yes	40 (67.8)	19 (32.8)		47 (79.7)	12 (20.3)	
Neglect						
No	1999 (80.7)	479 (19.3)	9.27 (0.002)	2205 (89.0)	272 (19.0)	9.27 (0.002)
Yes	32 (66.7)	16 (33.3)		36 (75.0)	12 (25.0)	
Age at substantiations						
No	1964 (80.8)	468 (19.2)	5.16 (0.023)	2167 (89.1)	264 (10.9)	9.84 (0.002)

5–14 years	67 (71.3)	27 (28.7)		74 (78.7)	20 (21.3)	
Frequency of substantiations*						
No	1946 (80.9)	459 (19.1)	11.16 (0.004)	2147 (89.3)	257 (10.7)	10.74 (0.005)
Only once	59 (74.7)	20 (25.3)		64 (81.0)	15 (19.0)	
Twice or more	26 (61.9)	16 (38.1)		30 (71.4)	12 (28.6)	

[a]Any childhood maltreatment included one or more combination of neglect, sexual, physical or emotional abuse.

*χ^2 (df = 2).

Additional analyses of the associations between childhood maltreatment and cannabis abuse and dependence after controlling for those participants who reported cannabis abuse (n = 17) and dependence (n = 15) outcomes before 14 years of age showed similar findings in all models (Table not shown). The gender–any childhood maltreatment interaction term was significant (interaction term = 0.11, $p < 0.0001$). However, the inclusion of the interaction term in the respective fully adjusted models controlling for the main effect of gender did not change the size and direction of the association between childhood maltreatment and cannabis use disorders (Online Table S3).

In unadjusted and adjusted multinomial models, childhood maltreatment was also associated with cannabis use with and/or without any DSM-disorder. All forms of childhood maltreatment were associated with increased odds of cannabis use without any disorder in unadjusted multinomial logistic regression models. After adjusting for all confounders/covariates, childhood maltreatment (OR = 1.78) and emotional abuse (OR = 2.15) were strongly associated with cannabis use without any disorder. Similar patterns of unadjusted associations were also reported for subtypes of childhood maltreatment, except sexual abuse, and cannabis use with any disorder. Exposure to any maltreatment (OR = 2.00) and neglect (OR = 3.21) were associated with cannabis use with any disorder, after adjusting for all confounders/covariates (Table 8).

On binary logistic regressions of missing values, maternal age at pregnancy (Online Table S4) as well as all forms of childhood maltreatment was associated with higher rates of missing values. All forms of childhood maltreatment were statistically significant predictors of missing values in multivariable analysis (Table not shown).

Table 2. Hierarchical logistic regression estimates of childhood maltreatment predicting cannabis abuse at 21-year, Brisbane, Australia.

Childhood maltreatment	Category	Unadjusted OR (95% CI)	Adjusted OR (95% CI)		
		Model 1	Model 2	Model 3	Model 4
Any maltreatment	No	1	1	1	1
Any maltreatment[a, b]	Yes	1.95 (1.19–3.17)**	1.79 (1.08–2.97)*	1.79 (1.08–2.96)*	-
Sexual abuse	Yes	0.79 (0.27–2.31)	0.93 (0.31–2.78)	0.93 (0.31–2.79)	0.97 (0.32–2.89)
Physical abuse	Yes	2.01 (0.97–4.17)	1.83 (0.86–3.89)	1.81 (0.85–3.85)	1.85 (0.87–3.93)
Emotional abuse	Yes	2.29 (1.16–4.54)*	1.96 (0.97–3.98)	1.95 (0.96–3.96)	1.98 (0.98–4.02)
Neglect	Yes	2.91 (1.34–6.31)**	2.58 (1.15–5.75)*	2.58 (1.16–5.77)*	2.62 (1.17–5.86)*

[a]Any childhood maltreatment included one or more combination of neglect, sexual, physical or emotional abuse.

[b]Model did not adjust for other forms of childhood maltreatment.

Model 1. Unadjusted child maltreatment and cannabis abuse.

Model 2. Model 1 + gender at birth, maternal age at pregnancy, maternal smoking at pregnancy and 6 months postpartum and family poverty over the first 5 years of age.

Model 3. Adjusted for Models 1 + 2 + educational level and marital status at 21 years.

Model 4. Adjusted for Models 1 + 2 + 3 + any substantiated childhood maltreatment excluding the variable of interest to avoid the effect of overlapping maltreatment.

*$p < 0.05$; **$p < 0.01$.

Table 3. Hierarchical logistic regression estimates of childhood maltreatment predicting early age of onset of cannabis abuse at 21-year, Brisbane, Australia.

Childhood maltreatment	Category	Unadjusted OR (95% CI)	Adjusted OR (95% CI)		
		Model 1	Model 2	Model 3	Model 4
Any maltreatment	No	1	1	1	1
Any maltreatment[a, b]	Yes	3.36 (1.67–6.76)***	2.77 (1.35–5.69)**	2.77 (1.35–5.68)**	-
Sexual abuse	Yes	-	-	-	-
Physical abuse	Yes	2.97 (1.03–8.63)*	2.39 (0.81–7.08)	2.36 (0.79–7.00)	2.51 (0.84–7.44)
Emotional abuse	Yes	4.42 (1.79–10.88)***	3.50 (1.39–8.79)**	3.48 (1.39–8.74)**	3.59 (1.43–9.01)**
Neglect	Yes	3.89 (1.32–11.50)*	3.28 (1.09–9.91)*	3.30 (1.09–9.97)*	3.48 (1.15–10.52)*

[a]Any childhood maltreatment included one or more combination of neglect, sexual, physical or emotional abuse.

[b]Model did not adjust for other forms of childhood maltreatment.

Model 1. Unadjusted child maltreatment and cannabis abuse.

Model 2. Model 1 + gender at birth, maternal age at pregnancy, maternal smoking at pregnancy and 6 months postpartum and family poverty over the first 5 years of age.

Model 3. Adjusted for Models 1 + 2 + educational level and marital status at 21 years.

Model 4. Adjusted for Models 1 + 2 + 3 + any substantiated childhood maltreatment excluding the variable of interest to avoid the effect of overlapping maltreatment.

*$p < 0.05$; **$p < 0.01$; ****$p < 0.0001$.

Table 4. Hierarchical logistic regression estimates of childhood maltreatment predicting cannabis dependenceat 21-year, Brisbane, Australia.

Childhood maltreatment	Category	Unadjusted OR (95% CI)	Adjusted OR (95% CI)		
		Model 1	Model 2	Model 3	Model 4
Any maltreatment	No	1	1	1	
Any maltreatment[a, b]	Yes	2.69 (1.58–4.61)****	2.48 (1.43–4.30)***	2.47 (1.43–4.29)***	-
Sexual abuse	Yes	1.12 (0.33–3.77)	1.21 (0.35–4.14)	1.22 (0.36–4.19)	1.30 (0.38–4.47)
Physical abuse	Yes	3.03 (1.39–6.58)**	2.79 (1.26–6.18)*	2.72 (1.23–6.01)*	2.81 (1.27–6.22)*
Emotional abuse	Yes	2.70 (1.26–5.81)*	2.39 (1.09–5.20)*	2.36 (1.80–5.15)*	2.44 (1.12–5.33)*
Neglect	Yes	2.93 (1.22–7.01)**	2.54 (1.05–6.19)*	2.57 (1.05–6.25)*	2.68 (1.09–6.52)*

[a]Any childhood maltreatment included one or more combination of neglect, sexual, physical or emotional abuse.

[b]Model did not adjust for other forms of childhood maltreatment.

Model 1. Unadjusted child maltreatment and cannabis dependence.

Model 2. Model 1 + gender at birth, maternal age at pregnancy, maternal smoking at pregnancy and 6 months postpartum and family poverty over the first 5 years of age.

Model 3. Adjusted for Models 1 + 2 + educational level and marital status at 21 years.

Model 4. Adjusted for Models 1 + 2 + 3 + any substantiated childhood maltreatment excluding the variable of interest to avoid the effect of overlapping maltreatment.

*$p < 0.05$; **$p < 0.01$; ***$p < 0.001$; ****$p < 0.0001$.

Table 5. Hierarchical logistic regression estimates of childhood maltreatment predicting early age of onset of cannabis dependence at 21-year, Brisbane, Australia.

Childhood maltreatment	Category	Unadjusted OR (95% CI)	Adjusted OR (95% CI)		
		Model 1	Model 2	Model 3	Model 4
Any maltreatment	No	1	1	1	
Any maltreatment[a, b]	Yes	4.21 (1.83–9.69)***	3.72 (1.59–8.75)**	3.72 (1.58–8.73)**	-
Sexual abuse	Yes	-	-	-	-
Physical abuse	Yes	5.59 (1.89–16.54)**	4.86 (1.62–14.61)**	4.83 (1.60–14.55)**	5.09 (1.69–15.39)**
Emotional abuse	Yes	3.61 (1.07–12.19)*	3.16 (0.92–10.81)	3.14 (0.92–10.77)	3.39 (0.99–11.68)
Neglect	Yes	5.14 (1.49–17.69)***	4.54 (1.29–15.90)*	4.56 (1.30–15.96)*	4.92 (1.40–17.25)*

[a]Any childhood maltreatment included one or more combination of neglect, sexual, physical or emotional abuse.

[b]Model did not adjust for other forms of childhood maltreatment.

Model 1. Unadjusted child maltreatment and cannabis dependence.

Model 2. Model 1 + gender at birth, maternal age at pregnancy, maternal smoking at pregnancy and 6 months postpartum and family poverty over the first 5 years of age.

Model 3. Adjusted for Models 1 + 2 + educational level and marital status at 21 years.

Model 4. Adjusted for Models 1 + 2 + 3 + any substantiated childhood maltreatment excluding the variable of interest to avoid the effect of overlapping maltreatment.

*$p < 0.05$; **$p < 0.01$; ****$p < 0.0001$.

Table 6. Adjusted odds ratio (95% CIs) estimates of childhood maltreatment predicting cannabis use disorders at 21-year for weighted data, Brisbane, Australia.

Childhood maltreatment	Category	Cannabis abuse	Cannabis dependence
Any maltreatment	No	1	1
Any maltreatment[a, b]	Yes	1.80 (1.08–2.99)*	2.48 (1.43–4.43)***
Sexual abuse	Yes	0.99 (0.33–2.99)	1.31 (0.38–4.53)
Physical abuse	Yes	1.86 (0.87–3.96)	2.82 (1.27–6.24)*
Emotional abuse	Yes	1.99 (0.98–4.05)	2.45 (1.12–5.35)*
Neglect	Yes	2.63 (1.18–5.89)*	2.68 (1.10–6.54)*

[a]Any childhood maltreatment included one or more combination of neglect, sexual, physical or emotional abuse.

[b]Model did not adjust for other forms of childhood maltreatment.

Adjusted for gender at birth, maternal age at pregnancy, maternal smoking at pregnancy and 6 months postpartum.

and family poverty over the first 5 years of age, educational level and marital status at 21 years, and for respective composite variables to avoid the effect of overlapping maltreatment.

*$p < 0.05$; ***$p < 0.001$.

Table 7. Adjusted logistic regression estimates of number of substantiations predicting cannabis abuse, early age of onset of cannabis abuse and dependence, Brisbane, Australia.

Frequency of maltreatment	Adjusted OR (95% CI)[a]			
	Cannabis abuse	**Early age of onset of cannabis abuse**	**Cannabis dependence**	**Early age of onset of cannabis dependence**
Number of substantiations[b]				
Once only	1	1	1	1
Two or more times	1.51 (1.06–2.16)*	1.97 (1.36–2.84)****	1.87 (1.27–2.74)***	2.67 (1.55–4.59)****
Number of substantiations[c]				
Once only	1	1	1	1
Two or more times	1.52 (1.06–2.19)*	2.09 (1.31–3.36)****	1.88 (1.28–2.76)***	2.71 (1.57–4.68)****

[a]Adjusted for gender at birth, maternal age at pregnancy, maternal smoking at pregnancy and 6 months postpartum and family poverty over the first 5 years of age, educational level and marital status at 21 years.

[b]Models did not adjust for other forms of childhood maltreatment.

[c]The analyses involved weighted data.

*$p < 0.05$; ***$p < 0.001$; ****$p < 0.0001$.

Table 8. Unadjusted and adjusted multinomial logistic regression odds ratio estimates of childhood maltreatment predicting cannabis use with and/or without DSM-IV disorder at 21-year, Brisbane, Australia.

Childhood maltreatment	Never cannabis use	Ever cannabis use without DSM-IV disorder (95% CI)		Cannabis use with any DSM-IV disorder (95% CI)	
		Unadjusted	Adjusted	Unadjusted	Adjusted
Any maltreatment[a, b]	1	1.93 (1.29–2.88)***	1.78 (1.1.19–2.67)**	2.26 (1.48–3.46)****	2.00 (1.29–3.11)**
Sexual abuse	1	2.29 (1.21–4.36)*	1.58 (0.69–3.61)	1.25 (0.53–2.97)	1.09 (0.35–3.39)
Physical abuse	1	2.44 (1.33–4.47)**	1.48 (0.70–3.11)	2.47 (1.27–4.79)**	1.56 (0.68–3.56)
Emotional abuse	1	2.78 (1.60–4.82)****	2.15 (1.05–4.39)*	2.62 (1.42–4.84)**	2.10 (0.95–4.65)
Neglect	1	2.43 (1.29–4.57)**	1.57 (0.64–3.89)	3.09 (1.61–5.95)***	3.21 (1.39–7.35)**

The reference category is: *Not any childhood maltreatment.*

[a]Any childhood maltreatment included one or more combination of neglect, sexual, physical or emotional abuse.

Adjusted for gender at birth, maternal age at pregnancy, maternal smoking at pregnancy and 6 months postpartum and family poverty over the first 5 years of age, educational level and marital status at 21 years.

$^{*}p < 0.05$; $^{**}p < 0.01$; $^{***}p < 0.001$; $^{****}p < 0.0001$.

Discussion

We examined the prospective association between specific forms of substantiated childhood maltreatment and subsequent cannabis abuse or dependence while controlling for potential confounders and/or covariates including other types of maltreatment. We also tested the effect of multiple episodes of maltreatment.

This paper extends an earlier study on the effects of substantiated childhood maltreatment on cannabis use disorders (13) using the same dataset in the following ways. First, we adjusted for maternal pregnancy and postnatal cigarette smoking because this is a risk factor for neurobehavioural and cognitive disorders in their children (e.g., ADHD, externalising, etc.) (31), as well as psychotic symptoms (32), drug dependence (33), alcohol and cannabis use (34). Second, we also adjusted for other concurrent types of childhood maltreatment to further investigate the independent effect of each type of childhood maltreatment. Third, we adjusted for gender-childhood maltreatment interaction term in addition to the main effect of gender. Fourth, we included analyses of missing values and weighted data to account for attrition, and used the number of incidents of childhood maltreatment substantiations as indicators of severity while examining cannabis use and early age of onset of cannabis use disorders. Fifth, we explored differences between cannabis use, use disorders and dependence. The previous study collapsed the latter two and did not directly compare cannabis use with and/or without any cannabis DSM-IV disorder. Sixth, we used DSM-IV age of onset of cannabis use and dependence disorders separately and supplemented the findings with a continuous age of onset. We did this because dichotomising continuous variables has several disadvantages including the loss of statistical power, as well as the making of variability and non-linearity in the association between the variable of interest and outcome (39). Moreover, the current paper controlled for those who reported cannabis abuse and dependence before the age of 14 years to account for possible overlap between exposure to childhood maltreatment and early onset cannabis abuse and dependence, whereas Mills et al. reported age of cannabis use from a single self-reported survey item (13). In addition, Mills and colleagues did not compare age of onset of use and dependence, and did not account for possible overlap between childhood maltreatment and early age of onset of cannabis use. Finally, duplication of the cannabis use variable was eliminated by combining and collapsing cannabis use with DSM-IV disorders yielding three comparable categories: *never used, ever used with no DSM-IV disorders,* and *use with DSM-IV disorders*. This was imperative to compare the effects of episodic or subthreshold levels of cannabis use with persistent or clinically evident disorders. Moreover, a continuous age of onset of cannabis use variable has been used in this paper.

We found that substantiated childhood maltreatment was associated with cannabis abuse and dependence including earlier onset of use and dependence. Our further analyses also showed similar findings for cannabis use with and/or without any cannabis use disorder. This was particularly true of each form of maltreatment, except sexual abuse, and when there are multiple forms and episodes of maltreatment. The specific associations may be explained by *differential effects model* (39) where individual maltreatment type leads to specific detrimental developmental outcomes (38, 39) including substance use disorders (46). According to the *general effects model* (39), co-occurring (46) and multiple episodes of maltreatment, may also predict later psychopathic conditions through poor coping strategies, behavioural maladaptation (18, 47), and substance use disorders including cannabis (46). Indeed, an earlier study using the same dataset reported that different types of substantiated childhood maltreatment predicted cannabis use disorders overall (13). Our findings build on that body of knowledge by further investigating the effect of childhood maltreatment on the severity of cannabis use as shown by the presence of dependence. The study addresses the main methodological limitation of the field by statistically partitioning the independent effects of specific and multiple forms of childhood maltreatment (48, 49). Notably, the analyses that controlled for cannabis use disorders before 14 years of age revealed consistent findings, confirming an independent longitudinal association between childhood maltreatment and cannabis use disorders. Additionally, the prospective evaluation of cannabis use disorders across late childhood period enables us to investigate the chronic developmental impact of childhood maltreatment (50, 51). This is important because the risk of childhood maltreatment in later stages of childhood development (20) and subsequent substance use is substantial (52).

The association between childhood maltreatment and cannabis use disorders persisted after adjustment for a range of potential parental and individual confounders. All models controlled for concurrent socioeconomic covariates including the level of education and marital status of the young adults while predicting cannabis use disorders. The association between childhood maltreatment and cannabis use disorders may be direct and/or both may have common risk factors. For instance, maternal prenatal and postnatal substance abuse may lead to childhood maltreatment (21) through poor child monitoring and protection (53), which, in turn, may predict child substance use (53) including cannabis. A maternal stressful environment (54) including cigarette smoking (21) may also lead to childhood maltreatment (21), increase behavioural disorganisation, disruption, instability (53), poor impulse control and less academic achievement (31). Exposure to these maternal stresses may be associated with poor neurobehavioural (31, 54) pathways and cognitive outcomes, with subsequent poor executive functioning (55) including poor educational achievement (22, 56) and addiction (54), particularly in early cannabis users (55). Future research that considers

these intermediate variables may help describe possible pathways that link early childhood adversity and subsequent cannabis use disorders.

Unlike all the other forms of childhood maltreatment, however, sexual abuse was not associated with any cannabis use disorders. In contrast to prior studies (12), however, sexual abuse was not significantly associated with cannabis use disorders. For instance, it is possible that sexual abuse is underreported (57) because of inconsistent definitions (57), secrecy (58) and stigma (59). Conversely, the nature and severity of sexual abuse (60, 61), may mean that it is more likely to be reported and attract an agency response before there is progression to long-term disorders (61) involving cannabis use. In addition, restricting our definition of childhood maltreatment to substantiated cases, as well as higher rates of attrition in these cases may underestimated actual levels of maltreatment (62) and so affected the statistical power to detect significant associations, especially for sexual abuse.

Although exploring the mechanism of association between childhood maltreatment and cannabis use disorders is beyond the scope of the current study, cannabis use disorders may result from PTSD (63), or subsequent concurrent symptoms of posttraumatic disorder (64) that persist across the lifespan (65). Maltreated individuals (66) may tend to have other unwanted consequences (67), which may also predict cannabis abuse (3). For example, physical (68) and emotional abuse, and neglect (46, 69) may have effect on cognitive, emotional and behavioural outcomes (46). Consequently, maltreated children may be at risk for early initiation of substance use that may, in turn, lead to later substance use disorders (14).

Some limitations of the study should also be considered. The use of legally defined cases are likely to underestimate the true prevalence of childhood maltreatment (62) and may account for the observed weak associations, particularly for sexual abuse (57). Maltreated children may have substantially higher rates of early alcohol and tobacco use (70), possibly *gateways* to subsequent cannabis use (71). Although we could not disentangle this effect (71, 72), a previous study using the same study sample showed self-reported sexual abuse before the age of 16 years led to frequent cannabis use after excluding those participants who reported concurrent use of other illicit drugs and restricting the analysis for those who reported cannabis use only (12). Concurrent psychopathologies (9) may mediate or moderate the association between childhood maltreatment and cannabis use disorders (73); the observed associations may perhaps have accounted for concurrent mental health disorders and subsequent substance use (74). That is, maltreated individuals may have cannabis disorders due to underlying poor mental health and subsequent misuse of drugs (75). Moreover, the potency of cannabis use was not assessed, which may influence patterns of association with cannabis use disorders. Finally, carrying out a substantial number of

analyses may have introduced Type I error, although the patterns of results were similar suggesting consistency of the observed findings.

Although there may be many risk factors for cannabis use disorders, our findings revealed strong associations between single and multiple forms of childhood maltreatment and cannabis use disorders that may have specific implications for the prevention of subsequent cannabis abuse and dependence including an early age of onset of these disorders. An early age of onset of cannabis use has both public health and clinical implications (76), as it predicts later abuse and dependence (14, 76, 77), and other adverse health, psychosocial (76) and neuropsychiatric disorders, possibly through impaired brain development (78) or distorted neuroendocrine mechanisms (54). As such, prevention of childhood maltreatment along with tracking a history of cannabis use disorders would lessen the problem. This may involve community-based prevention in the early childhood period (79) along with and appropriate clinical approaches that promote resiliency (80), and focus on possible causes (81) or consequences of cannabis abuse (82). Given similar association of cannabis abuse and dependence with childhood maltreatment, these children may be at higher risk for both episodic and longer-term (i.e., dependence) cannabis use disorders. As such, this study established associations between childhood maltreatment and cannabis use without any diagnosable disorder, implying a higher risk of subthreshold level cannabis use among participants with a history of maltreatment. This was supported by our supplementary analyses showing a strong association between childhood maltreatment and age of onset of cannabis abuse.

Conclusions

Childhood maltreatment was strongly and consistently associated with cannabis abuse and dependence, as well as cannabis use with and/or without any disorder. Emotional abuse, neglect and exposure to more episodes of maltreatment independently predicted cannabis use disorders. There was no evidence for the effect of any interaction between gender and different forms of childhood maltreatment on adulthood cannabis use disorders. Earlier interventions for childhood maltreatment may be a significant public health effort that may also reduce the effect of maltreatment on later cannabis use disorders. However, this requires an evidence-based approach which trades-off the cost and unintended consequences of an intervention against the benefits likely to be derived.

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Childhood maltreatment, psychotic experiences and psychosis

Published manuscript (click here to access full length article) and cited as:

Abajobir AA, Kisely S, Scott JG, Williams G, Clavarino A, Strathearn L, Najman JM. Childhood maltreatment and young adulthood hallucinations, delusional experiences and psychosis: a longitudinal study. Schizophr Bull. 2017;43(5):1045–55.

Objective: This study examined the association between substantiated child maltreatment and self-reported psychotic experiences hallucination and delusion, as well as a 12 month or lifetime diagnosis of non-affective psychosis.

Supplementary analyses: Data pertaining to distribution of flow of the study and predictors of attrition were published online and available at: Supplementary data.

Abstract

Child maltreatment is a widespread public health problem associated with a range of mental health disorders later in life. In order to effectively address these disorders, there is a need to understand more about the mental health consequences of different types of child maltreatment. This study examines the associations between prospectively substantiated child maltreatment (ages 0–14 years) and reports of hallucinations and delusional experiences at 21 years after birth. As well, we examined 12 month and lifetime psychotic disorders using data from a longitudinal birth cohort. The study comprised 3752 participants from the MUSP, a prospective Australian pre-birth cohort study. Psychotic experiences, and 12 month and lifetime psychosis were measured using the Achenbach YASR, the PDI and CIDI at the 21-year follow-up. In adjusted analyses, those children who had experienced any maltreatment, who were emotionally abused and neglected, were more likely to report (i) hallucinations and lifetime delusional experiences; and (ii) more likely to experience lifetime psychosis than their nonabused counterparts. In expanded models, those exposed to multiple forms of maltreatment, in particular with emotional abuse and neglect, had an increased likelihood of hallucinations and delusional experiences. There is an association between child maltreatment, especially emotional abuse and neglect, and later hallucinations, delusional experiences and psychosis. It is, however, relevant to note that the vast majority of children experiencing childhood maltreatment do not appear to develop psychotic experiences or psychotic disorder. Further research to determine the reasons for highly variable outcomes of child maltreatment is warranted.

Keywords: child maltreatment, hallucinations, delusions, psychosis, young adults, birth cohort

Introduction

Child maltreatment is a widespread public health problem leading to a range of mental health disorders later in life. An association between childhood maltreatment and psychotic disorders has been reported in two systematic reviews (1, 2) although there are three limitations commonly seen in studies examining this association. These include reliance on cross-sectional designs that have used self-report measures of child maltreatment (3-7) in clinical samples with the consequent possibilities of recall, help-seeking or rumination bias (7, 8). There has also been a tendency to focus on a specific type of maltreatment (3, 5, 6, 9) particularly sexual abuse (8, 10) with less emphasis on emotional abuse and neglect. Furthermore, many studies have considered specific types of child maltreatment, for example, sexual abuse, despite the fact that child maltreatment often co-occurs with other forms of abuse or neglect (11, 12). For instance, exposure to two or more overlapping types of child maltreatment referred to as *multitype* (11) or *expanded hierarchical type* maltreatment (12), may be associated with differing mental health outcomes. The inclusion of multiple types of child maltreatment can therefore provide a better understanding of the association between child maltreatment and psychosis (13). Finally, developmental delays and childhood emotional and behavioural problems (4, 14-16) may also confound the relationship between child maltreatment and psychosis in adulthood. In addition, children exposed to maltreatment may be at increased risk of alcohol use (17) and cigarette smoking (18) established antecedents for psychosis (17, 19). Childhood maltreatment and psychotic experiences may also share some common antecedents including gender (20), poor academic performance (21), poverty (22), poor parental mental health (23) and environmental disadvantages including living in a neighbourhood problem area (24).

As a result of these methodological limitations, an explanation for the association between psychosis and earlier childhood maltreatment, as an independent risk factor, remains unclear (13). To our knowledge, none of the available studies have examined the association between independently verified maltreatment in childhood and later psychotic experiences or psychotic disorder while controlling for childhood and adolescence emotional and behavioural problems, alcohol use and cigarette smoking, as well as young adulthood social deprivation.

This study therefore examined the association between different types of substantiated child maltreatment and self-reported psychotic experiences as measured by the YASR items and the PDI using data from a large population-based birth cohort study. Furthermore, we investigated any association between the number of maltreatment reports and hallucinatory or delusional experiences. The study also assessed whether child maltreatment was associated with a 12 month or lifetime diagnosis of non-affective psychosis using the CIDI.

Methods and Statistics

Study design and participants

Data are from the MUSP. This is a prospective pre-birth cohort of mothers recruited consecutively during their FCV at MMMH from 1981 through to 1983 in Brisbane, Australia. A total of 8556 mothers were initially approached and 8458 accepted the invitation. Of these, 7223 gave birth to a live, singleton baby at the hospital, who neither died nor was adopted out prior to discharge. Mothers were assessed at 3–5 days and 6 months postpartum, as well as at 5, 14 and 21 years of the index child's age. Children were also assessed at all the follow-ups (25, 26). The MUSP data have been linked to substantiated cases of child maltreatment reported to the child protection government agency up to the age of 14 years. The current study consisted of those young adults for whom there were complete data on hallucinations, delusional experiences, and DSM-IV psychosis at the 21-year follow-up (Online eFigure 1).

Measures

Substantiated childhood maltreatment

Alleged cases of childhood maltreatment (including physical, sexual and emotional abuse, and neglect) are notified to the child protection agency. This study used state-wide child protection records of childhood maltreatment up to 14 years of age. Notifications of maltreatment included mandatory reports from medical practitioners and referrals from the general public to FYCCQ. Notified cases of childhood maltreatment were investigated by child protection caseworkers and then there was a determination of whether suspected cases were substantiated. Substantiated cases of maltreatment included those confirmed cases by FYCCQ with evidence of "reasonable cause to believe that the child had been, was being, or was likely to be abused or neglected." Substantiated sexual abuse included when there was confirmation for "exposing a child to, or involving a child in, inappropriate sexual activities." Physical abuse involved "any nonaccidental physical injury inflicted by a person who had care of the child." Emotional abuse included "any act resulting in a child suffering any kind of emotional deprivation or trauma." Similarly, childhood neglect encompassed a "failure to provide conditions that were essential for the healthy physical and emotional development of a child." Childhood experiences of *neglect* were intended to incorporate both physical and emotional neglect by those who were taking care of a child (27). Data were anonymously linked to the MUSP longitudinal database (28). The present study used four hierarchical categories of substantiated childhood maltreatment cases (i.e., sexual, physical and emotional abuse, and neglect) (12) to examine the associations between each form of child maltreatment and psychosis outcomes. The *no maltreatment* was used as a reference group. Given overlaps across subtypes of childhood maltreatment, the study used *multitype* (11) or *expanded*

hierarchical (12) childhood maltreatment models to examine the associations between co-occurring multiple types of childhood maltreatment and psychosis outcomes. The *multitype* model encompasses the effects of multiple exposures to more than one form of child maltreatment (11). This model represents exposure to multiple forms of child maltreatment so as to assess whether there were any changes in the strengths of the associations between *polyvictimisation* and the outcomes. It also serves as a proxy measure for a higher severity of exposure to maltreatment. This scheme of child maltreatment classification has greater predictive validity in substantiated cases of childhood maltreatment (12). Frequency of maltreatment substantiation (29) was recorded and the associated outcomes were examined. The two categories of number of childhood maltreatment substantiations were used todetermine outcomes included *only one episode* and *two and more episodes*, as well as *no maltreatment* (reference group).

Assessment of psychosis outcomes

The study used two items from Achenbach's YASR Behaviour Checklist (30) to assess for psychotic experiences, including hallucinations, over the previous 6 months: *I hear sound or voices that other people think are not there* (*auditory hallucination* hereafter); and *I see things that other people think are not there* (*visual hallucination* hereafter). The responses were recorded on three Likert scales: (i) not true; (ii) somewhat or sometimes true; and (iii) very or very often true. The latter two were combined into one category and the hallucination responses dichotomised as *not true* (reference) and *sometimes/very often true*.

The reliability of self-report measures for assessing hallucinations in adolescents has been established (31). Of all psychotic experiences, self-reported hearing voices or sounds that others do not hear was the strongest predictor of clinically verifiable auditory hallucinations (positive predictive value [PPV] = 71.4% and negative predictive value [NPV] = 90.4%), with visual hallucinations also showing moderate predictive power (PPV = 81.8% and NPV = 80%) (31). Hallucination items from the YASR have been used in previous longitudinal studies (32, 33).

The analyses also used the 21 item (α = 0.80) PDI to assess delusional experiences (*delusions* hereafter) at the 21-year follow-up. Young adults were invited to endorse whether they ever had experiences, such as *feel as if people seem to drop hints about them or say things with a double meaning, things in magazines or on TV were written especially for you*, etc. using a forced no (1) or yes (2) response options. The PDI was derived from the Present State Examination (34) and has been validated in clinical (35) and population (36) samples. The response scores were summed and defined *normal* and *elevated* (top decile).

Twelve month and lifetime non-affective psychosis, based on the DSM-IV (37) was assessed using the CIDI-Auto Version 2.1 (38) at 21 years of age. The DSM-IV has been validated

for non-affective psychosis in clinical samples (39). Specific diagnoses identified using the CIDI-Auto module were any DSM-IV diagnoses of schizophrenia, schizophreniform, schizoaffective, delusional and brief psychotic disorders with ICD-10 codes of 295, 295.4, 295.7, 297.1 and 298.8, respectively. Overall, a total of 19 participants met diagnostic criteria for non-affective psychosis in the past 12 months and 36 DSM-IV lifetime psychosis cases were identified**.**

Confounders

We adjusted for potential confounders on the basis of bivariate analyses or from the literature (17-24). These were grouped into the following three categories.

Early childhood and adolescence behaviour problems

We included maternal reports of ADHD symptoms in their child at the age of 5 years using 6 items ($\alpha = 0.67$) from the CBCL (40). The problems included the following: *the child acts too young for his/her age, concentration problems, restlessness, lost in thoughts, nervousness, and poor coordination.* These items were recoded and rated on three scales: never = 0; sometimes = 1; and often = 2. The total score ranged from 0–12. The scale was then dichotomised into *normal* for scores of 0–6 and *elevated* for scores between 7 and 12. The ADHD subscale of the CBCL is a widely used and well validated instrument for assessing symptoms of child psychopathology (41, 42).

The frequency of aggressive behaviour was assessed from maternal reports at 14 years old using 10 items ($\alpha = 0.85$) from the CBCL aggression short form (40). These items ranged from simple argument to involvement in physical attacks. This variable was rated and recoded as never = 1; sometimes = 2; and often = 3. The response to each item was summed and the top 10% cutoff (43) was used to dichotomise into *normal* versus *aggressive* behaviour.

Self-reported alcohol use and cigarette smoking status were obtained at 14 years. Adolescents were asked how often they drank alcohol and their responses were coded as *rarely-never* and *sometimes–often.* Adolescents were also asked how many cigarettes they smoked in the last week. Their responses were coded as *no* for nil and *yes* for 1–50+ smokes per week.

Young adult characteristics at the 21-year follow-up

The analyses included five sociodemographic characteristics: gender, receiving social security benefits, educational level, marital status and characteristics of their neighbourhood. The latter was assessed by asking how much of a problem various behaviours were in the area where they lived. The scale comprised 9 items ($\alpha = 0.81$). The items were: the presence of vandalism/graffiti, house burglaries, car stealing, violence in the streets, unemployment, noisy and/or reckless driving, alcohol and drug abuse, and school truancy. The measure had five response options ranging from do not know = 1 to major problem = 5. The top decile of mean scores was

taken to represent a *high* residential problem area and the variable was dichotomised into *normal* and *high*. Gender was coded male and female and included in the analyses. Baseline analyses of the association between child maltreatment and psychosis by gender did not show any statistically significant differences.

Maternal/family characteristics from early childhood through adolescence

The study included three maternal and/or familial characteristics from pregnancy through to when the child was 14 years old. Mean familial income was assessed at 4 points in time from pregnancy to 5 years. This was dichotomised into *mid-to-high income* (> $12,133 per year) versus *consistent poverty* (< $12,132 per year). These thresholds were based on estimates of the poverty level from 1981–83 (44). Additionally, maternal perceived stress from pregnancy through to 6 months postpartum was assessed using 4 items ($\alpha = 0.84$) and experience of stress was rated as never = 0; rarely = 1; some of the time = 2; most of the time = 3; and all the time = 4 (45). A composite variable for stress was created by summing reported symptoms from pregnancy to 6 months postpartum: *0–6 symptoms = nil* and *7–16 symptoms = stress*.

Violence in the home was assessed at 14 years using the modified CTS (46) with 7 items ($\alpha = 0.69$) asking whether disagreements at home were resolved with violent actions. Items were recoded as never = 1; sometimes = 2; and often = 3. Scores were summed to provide a composite variable where higher scores represented increased violence (*low/high*). The test re-test reliability of this scale has been found to be consistent (47).

Analyses

The characteristics of study participants with, and without, a history of child maltreatment were compared using Pearson's chi-squared statistic with two-tailed p-values. Analyses were undertaken for the male and female combined sample as there were no gender differences in psychotic outcomes and psychosis. Chi-squared tests were also used to compare the two groups for the presence of psychotic features at 21 years old. Logistic regression analyses were also carried out. First, unadjusted analyses were hierarchically done for each predictor and against each outcome. Second, a multivariable logistic regression model was used to adjust for the selected 12 confounders to obtain the maximum likelihood estimates of the adjusted ORs with 95% CIs and the independent effect of each predictor variable on psychotic experiences and psychotic disorder using a *not any maltreatment* category as a reference group. This category excluded both notifications and substantiations for any child maltreatment, representing the *never maltreated* group. Further, the associations between numbers of substantiated child maltreatment episodes, across psychotic outcomes, were examined by repeating the above models. The OR, as used in this study, is the increase in risk of psychotic experiences and psychotic disorder associated with an increase in the

child maltreatment value by one unit. Two sets of analyses were undertaken. In the first, all variables were entered into the model on the basis of being associated with the independent or dependent variables, theoretically, or on bivariate analysis. The second model was conducted as a sensitivity analysis. In this model, forward stepwise model was conducted in which variables were entered according to their association with each outcome until no more reached statistical significance. Only variables significantly associated with the outcome on multivariable analysis were included in the final run of this model. Finally, qualitative descriptors of the effect size for the ORs (48) were used to assess the magnitude and strength of the association for adjusted models. Small effect sizes were defined as ORs of less than 2, medium effects as ORs of between 2 and 4, and large effects as values of more than 4.

Attrition

To account for attrition, weighted analysis was carried out using IPW (49) in three steps. First, unadjusted logistic regression analyses were carried out for confounders included in the study against attrition as an outcome (*non-missing* versus *missing*) to identify those variables associated with attrition. Second, multivariable logistic regression analysis was used to determine independent predictors of attrition and to generate weights for each variable used in the study. Third, the final, fully adjusted models were repeated by including the weighted variable into the models to determine whether attrition had affected the findings.

Results

Data on psychotic experiences were available for up to 3752 participants at the 21-year follow-up (Online eFigure 1). In unadjusted attrition analyses, being female, consistent familial poverty over the first 5 years of age and violence in the home at the 14 year follow-up were associated with higher rates of attrition. None of this reached statistically significant levels in multivariable analyses of attrition (Online eTable 1). Substantiation of child maltreatment predicted higher rates of attrition, where about 33% substantiated cases were lost to follow-up.

In the birth cohort (n = 7223), there were 789 notifications for any maltreatment, of which 663 and 500 were for abuse and neglect respectively, after excluding 9 participants for whom child protection data were not available. Of the included participants, 4.5% (n = 167) had experienced any substantiated child maltreatment. The rates of any substantiated child maltreatment were associated with measures of social disadvantage. Those young adults who were receiving social security benefits (χ^2(df = 1) = 45.17, $p < 0.0001$), had incomplete high school education (χ^2(df = 1) = 72.04, $p < 0.0001$), who were never married (χ^2(df = 1) = 14.7, $p = 0.002$), were living in residential problem area (χ^2(df = 1) = 17.51, $p < 0.0001$) and had a mother who experienced chronic stress (χ^2(df = 1) = 12.29, $p = 0.002$), were more likely to have been exposed to child maltreatment.

These associations were similar across all forms of substantiated child maltreatment. Similarly, being on social security benefits ($p < 0.0001$), living in a problem area ($p < 0.0001$), aggression ($p = 0.004$), alcohol use ($p < 0.0001$) and cigarette use at 14 years ($p < 0.0001$) were significantly associated with hallucinations, delusional experiences, and psychosis in all models. Maternal reports of ADHD at 5 years old were associated with an increased risk of lifetime psychosis ($p < 0.001$).

The prevalence of both auditory and visual hallucinations was 7.1%. The rates were higher for those who experienced any form of child maltreatment (auditory: $p = 0.013$; visual: $p = 0.005$). Those who were emotionally abused and neglected were more likely to have auditory and visual hallucinations. Emotional abuse (OR = 2.73; 95% CI: 1.55–4.83) and neglect (OR = 3.26; 95% CI: 1.79–5.92) consistently showed increased risk of experiencing auditory hallucination in unadjusted analyses. Similarly, the risk of visual hallucination was higher for physical abuse (OR = 2.29; 1.19–4.41), emotional abuse (OR = 2.33; 95% CI: 1.27–4.25), and neglect (OR = 2.97; 95% CI: 1.61–5.49). In adjusted models, emotional abuse (OR = 1.83; 95% CI: 1.01–3.33) and neglect (OR = 2.14; 95% CI: 1.14–4.03) significantly and persistently associated with auditory hallucination even after adjustment. There was a small effect size for emotional abuse and a medium for neglect. Only neglect was associated with visual hallucination (OR = 2.28; 95% CI: 1.34–4.12) with a medium effect size in the adjusted model (Table 1).

Of the 3729 participants who had data for the PDI, 9.5% (n = 353) of individuals reported the highest decile for delusional experiences at the 21-year follow-up. Of these, 19.6% (n = 32) had experienced substantiated child maltreatment. Children who have experienced any maltreatment were about twice as likely to score in the highest decile of the PDI. In unadjusted logistic regression analyses, all forms of child maltreatment were associated with delusions, ORs ranging 2.31–3.78. These results remained significant after adjusting for potential confounding variables except in the cases of sexual and physical abuse. The adjusted ORs (95% CIs) were 2.13 (1.23–3.67) and 2.72 (1.54–4.82) for emotional abuse and neglect, respectively. The effect size for the association with delusional experiences was small for any maltreatment and medium for emotional abuse and neglect (Table 2).

In expanded hierarchical models, all composite categories that included different forms of child maltreatment were related to subsequent delusional experiences, with adjusted ORs of 1.89–3.68, except for *emotional abuse or neglect with physical abuse* category. These models had medium effect sizes. The combinations of emotional abuse (OR = 1.98; 95% CI: 1.06–3.69) and neglect (OR = 2.78; 95% CI: 1.37–5.68) were associated with auditory hallucination with small and medium effect sizes, respectively, in adjusted models. Similarly, physical abuse or neglect (OR =

1.79; 1.05–3.07) was associated with auditory hallucination and found to have small effect (Table 3). More frequent episodes of substantiated child maltreatment significantly associated with delusional experiences (OR = 1.47; 95% CI: 1.10–1.95) but not hallucinations. The effect sizes for the former were small (Table 4).

Table 1. Prevalence, unadjusted and adjusted ORs (95% CIs) of auditory and visual hallucinations at 21-year for specific forms of substantiated childhood maltreatment, Brisbane, Australia.

Child maltreatment	Auditory hallucinations (n = 3752)						Visual hallucinations (n = 3737)					
	%	Unadjusted OR		*p*-value	Adjusted OR	*p*-value	%	Unadjusted OR		*p*-value	Adjusted OR	*p*-value
Any maltreatment (No)	6.9	1			1		6.9	1			1	
Sexual abuse (Yes)	9.4	1.36	(0.54–3.45)	0.515	0.98	(0.38–2.56)	0.973	7.5	1.07 (0.38–2.98)	0.903	0.86 (0.30–2.48)	0.785
Physical abuse (Yes)	12.0	1.79	(0.89–3.65)	0.099	1.05	(0.49–2.21)	0.904	14.7	2.29 (1.19–4.41)	0.01	1.32 (0.65–2.69)	0.445
Emotional abuse (Yes)	16.9	2.73	(1.55–4.83)	< 0.0001	1.83	(1.01–3.33)	0.047	14.8	2.33 (1.27–4.25)	0.002	1.57 (0.82–2.99)	0.171
Neglect (Yes)	19.4	3.26	(1.79–5.92)	< 0.0001	2.14	(1.14–4.05)	0.018	18.1	2.97 (1.61–5.49)	< 0.0001	2.28 (1.34–4.12)	0.019

OR = odds ratio.

Adjusted for youth gender, ADHD at 5 years, alcohol use at 14 years, smoking at 14 years, aggressive behaviour at 14 years, receiving benefits, educational levels, marital status and residential problem area at 21-years and familial income over the first five years, chronic stress over first 6 months and maternal reports of violence in homes at 14 years.

Table 2. Prevalence, unadjusted and adjusted ORs (95% CIs) of delusions at 21-year for specific forms of substantiated childhood maltreatment, Brisbane, Australia.

Child maltreatment	**Top decile Peter's Delusional Inventory (n = 3729)**				
	%	**Unadjusted OR**	***p*-value**	**Adjusted OR**	***p*-value**
Any maltreatment (No)	9.3	1		1	
Sexual abuse (Yes)	19.2	2.31 (1.15–4.65)	0.015	1.86 (0.90–3.82)	0.093
Physical abuse (Yes)	20.3	2.49 (1.40–4.45)	0.001	1.46 (0.78–2.73)	0.240
Emotional abuse (Yes)	23.3	3.01 (1.80–5.03)	< 0.0001	2.13 (1.23–3.67)	0.007
Neglect (Yes)	27.5	3.78 (2.20–6.49)	< 0.0001	2.72 (1.54–4.82)	0.001

Adjusted for youth gender, ADHD at 5 years, alcohol use at 14 years, smoking at 14 years, aggressive behaviour at 14 years, receiving benefits, educational levels, marital status and residential problem area at 21-years and maternal familial over the first five years, chronic stress over first 6 months and maternal reports of violence in homes at 14 years.

At the 21-year follow-up, there were CIDI data available on the presence of any DSM-IV diagnosis of psychosis for 2558 participants, the 12 month and lifetime prevalence being 19 (0.7%) and 36 (1.4%), respectively. In unadjusted analyses, emotional abuse was associated with 12 month (OR = 4.95; 95% CI: 1.12–21.89) and lifetime (OR = 3.86; 95% CI: 1.15–2.96) psychosis as was neglect (OR = 6.24; 95% CI: 1.41–27.77) for both 12 month and lifetime psychosis. In multivariable logistic regressions, those who were reported to have experienced emotional abuse were more likely to have experienced 12 month (OR = 5.83; 95% CI: 1.16–29.37) and lifetime (OR = 4.26; 1.17–15.54) psychosis. The odd of experiencing 12 month psychosis was greater in the neglected group (OR = 10.09; 95% CI: 2.06–49.34). The effects ranged from medium to large (4.26–10.09) (Table 5).

Those who were exposed to the composite categories of maltreatment that included emotional abuse, neglect and any maltreatment had increased odds of 12 month (OR = 14.99; 95% CI: 2.97–75.77) and lifetime psychosis (OR = 5.14; 95% CI: 1.04–25.36) compared with those who had not experienced maltreatment, after adjustment. Similarly, those who experienced any maltreatment (OR = 3.12; 95% CI: 1.13–8.61) and exposed to physical abuse or neglect were at greater risk of lifetime psychosis (OR = 4.48; 95% CI: 1.43–14.11). The effect sizes were medium to large ranging from 3.12–14.99 (Table 6). The greater the number of child maltreatment substantiations, the greater was the likelihood of a lifetime diagnosis of psychosis (Table 4).

We found similar results for all types of child maltreatment and all outcomes in the forward stepwise model where variables were entered according to their association with each outcome until no more reached statistical significance. Finally, analyses using weighted data did not significantly change both the magnitude and direction of association for all outcomes.

Table 3. Adjusted ORs (95% CIs) of auditory and visual hallucinations, and delusions at 21-year for substantiated co-occurring types of childhood maltreatment, Brisbane, Australia.

Child maltreatment	Category	Auditory hallucination	*p*-value	Visual hallucination	*p*-value	Top decile PDI score	*p*-value
Any maltreatment	No	1		1		1	
Any maltreatment [a]	Yes	1.31 (0.79–2.17)	0.298	1.56 (0.96–2.55)	0.075	1.89 (1.24–2.89)	0.003
Sexual abuse + [b]	Yes	2.29 (0.81–6.48)	0.117	1.96 (0.63–6.10)	0.244	3.27 (1.27–8.42)	0.014
Physical abuse or neglect	Yes	1.48 (0.85–2.57)	0.162	1.79 (1.05–3.07)	0.034	2.03 (1.26–3.26)	0.004
Emotional abuse + [c]	Yes	1.98 (1.06–3.69)	0.032	1.61 (0.82–3.18)	0.168	2.34 (1.26–3.96)	0.006
Neglect + [d]	Yes	2.78 (1.37–5.66)	0.005	2.06 (0.95–4.49)	0.067	3.68 (1.90–7.12)	< 0.0001
Emotional abuse + Neglect	Yes	1.48 (0.72–3.06)	0.286	1.41 (0.66–2.99)	0.371	2.04 (1.09–3.81)	0.025
Emotional abuse or neglect + physical abuse	Yes	1.36 (0.61–3.03)	0.451	1.47 (0.66–3.27)	0.340	1.60 (0.79–3.25)	0.190

Adjusted for youth gender, ADHD at 5 years, alcohol use at 14 years, smoking at 14 years, aggressive behaviour at 14 years, receiving benefits, educational levels, marital status and residential problem area at 21-years and familial income over the first five years, chronic stress over first 6 months and maternal reports of violence in homes at 14 years. [a]included one or more forms of substantiated sexual, physical, emotional abuse and neglect; [b]one or more substantiations for physical and emotional abuse, and neglect; [c]one or more substantiated sexual and physical abuse, and neglect; [d]one or more substantiated sexual, physical and emotional abuse.

Table 4. Adjusted ORs (95% CIs) of delusions, auditory, visual hallucinations and last 12 months and lifetime psychosis at 21-year for number of episodes of childhood maltreatment substantiations, Brisbane, Australia.

Episodes of maltreatment substantiations	Auditory hallucination (n = 3752)	*p*-value	Visual hallucination (n = 3737)	*p*-value	Top decile delusion score (n = 3729)	*p*-value	Any last 12 months DSM-IV psychosis	*p*-value	Any lifetime DSM-IV psychosis	*p*-value
Nil	1		1		1		1		1	
Only once	1.19 (0.97–1.44)	0.091	1.19 (0.97–1.46)	0.089	1.34 (1.12–1.61)	0.001	1.35 (0.60–3.03)	0.469	1.65 (1.00–2.71)	0.05
Two or more	1.27 (0.92–1.76)	0.145	1.22 (0.87–1.72)	0.244	1.47 (1.10–1.95)	0.008	1.79 (0.66–4.82)	0.252	2.29 (1.16–4.55)	0.017

Adjusted for youth gender, ADHD at 5 years, alcohol use at 14 years, smoking at 14 years, aggressive behaviour at 14 years, receiving benefits, educational levels, marital status and residential problem area at 21-years and familial income over the first five years, chronic stress over first 6 months and maternal reports of violence in homes at 14 years.

Table 5. Prevalence, unadjusted and adjusted ORs (95% CIs) of any last 12 month and lifetime DSM-IV psychosis at 21-year for substantiated childhood maltreatment (n = 2558), Brisbane, Australia.

Child maltreatment	Category	%	Unadjusted OR	*p*-value	Adjusted OR	*p*-value
		Any last 12 months DSM-IV psychosis				
Any maltreatment	No	0.7	1		1	
Emotional abuse only	Yes	3.3	4.95 (1.12–21.89)	0.010	5.83 (1.16–29.37)	0.039
Neglect only	Yes	4.4	6.24 (1.41–27.77)	0.003	10.09 (2.06–49.34)	0.006
Any lifetime DSM-IV psychosis						
Any maltreatment	No	0.7	1		1	
Emotional abuse only	Yes	8.6	3.86 (1.15–12.96)	0.009	4.26 (1.17–15.54)	0.025
Neglect only	Yes	5.6	6.24 (1.41–27.77)	0.027	3.26 (0.71–15.05)	0.134

Adjusted for youth gender, ADHD at 5 years, alcohol use at 14 years, smoking at 14 years, aggressive behaviour at 14 years, receiving benefits, educational levels, marital status and residential problem area at 21-years and familial income over the first five years, chronic stress over first 6 months and maternal reports of violence in homes at 14 years.

Table 6. Adjusting ORs (95% CIs) of last 12 months and lifetime psychosis at 21-year for co-occurring substantiated childhood maltreatment (n = 2558), Brisbane, Australia.

Child maltreatment	Category	Any last 12 months DSM-IV psychosis	*p*-value	Any lifetime DSM-IV psychosis	*p*-value
Any maltreatment	No	1		1	
Any maltreatment[a]	Yes	3.11 (0.59–16.23)	0.372	3.12 (1.13–8.61)	0.036
Physical abuse or neglect	Yes	4.71 (0.96–23.09)	0.081	4.48 (1.43–14.11)	0.013
Neglect + [b]	Yes	14.99 (2.97–75.77)	0.002	5.14 (1.04–25.36)	0.030

Adjusted for youth gender, ADHD at 5 years, alcohol use at 14 years, smoking at 14 years, aggressive behaviour at 14 years, receiving benefits, educational levels, marital status and residential problem area at 21-years and familial income over the first five years, chronic stress over first 6 months and maternal reports of violence in homes at 14 years. [a]Any maltreatment included one or more substantiated sexual, physical, emotional abuse and neglect; [b]one or more substantiations for sexual, physical and emotional abuse.

Discussion

The current study, to our knowledge, is the first longitudinal study to establish an association between prospectively substantiated child maltreatment and subsequent hallucinations, delusional experiences and a diagnosis of psychosis, whilst adjusting for a wide range of confounding factors. For instance, physical abuse was associated with visual hallucinations while any maltreatment, as well as emotional abuse and neglect, were associated with delusional experiences. These associations were consistent for those who experienced both emotional abuse and neglect and other co-occurring maltreatment. Finally, emotional abuse and neglect and any combination of maltreatment were associated with a 12 month and lifetime diagnosis of psychosis. Adjustment for all selected confounders including childhood ADHD symptoms, adolescent aggression, alcohol use and cigarette smoking did not substantially change the magnitude and direction of the association. The findings demonstrated small to very large effect sizes (48) in adjusted models, dependent on the psychosis outcome. Effect sizes were largest for the association between child maltreatment and later diagnoses of psychosis. Early emotional and behavioural problems, therefore, were unlikely to explain the observed associations between child maltreatment and psychosis.

This study has a number of strengths. It is the first to assess the association between co-occurring forms of substantiated child maltreatment and lifetime psychosis controlling for familial and individual level factors including markers of early emotional disorders, adolescence behaviour problems, alcohol use and cigarette smoking. The use of government-substantiated cases avoids any ambiguity regarding definitions of child maltreatment and reduces the chance of recall bias. The use of prospectively measured, agency-substantiated child maltreatment also has the advantage of identifying specific numbers and types of maltreatment over self-reported recall of childhood experiences at later stages of life (50). The inclusion of co-occurring child maltreatment also enabled the comparison of outcomes based on exposures to both single and multiple forms of maltreatment. This helps determine the degree to which different combinations of co-occurring maltreatment predispose to subsequent psychosis. The longitudinal assessment of a range of childhood and adolescence behaviour problems enabled adjustment for individual and familial factors. Lastly, the study revealed consistent findings across a range of child maltreatment categories suggesting reliability of child maltreatment measurement.

The current study also has some limitations. First, there was the extent of attrition in the sample that had occurred by the 21 year follow-up. We attempted to minimise the effects of this by weighted analysis using IPW. In addition, although emotional abuse or neglect were associated with later psychosis, the study could not determine whether physical or sexual abuse were independently

associated with psychosis. The use of substantiated official records may not have reflected the actual rates of child maltreatment. On the one hand, this may have underestimated the true prevalence of child maltreatment. On the other, it may have over-estimated the association with subsequent psychotic symptoms as our definition may have excluded less severe forms of child maltreatment that possibly do not lead to psychosis (50). Moreover, due to the small number of cases in each psychosis diagnosis, it was not possible to perform subgroup analyses to explore whether child maltreatment may have been associated with specific psychotic diagnoses such as schizophrenia. Twenty-one years old is a relatively young age for the diagnosis of psychosis and some of the sample may yet transition to psychosis at a later stage. The small sample size resulted in wide confidence intervals despite robust effect sizes for psychosis diagnosis, which may have rendered some associations nonsignificant due to lack of statistical power. Despite its psychometric properties, the CIDI may not adequately identify low prevalence disorders such as psychosis because of low sensitivity (51) and/or specificity (52). Ideally, we would have used clinical records but these were not available. Although child maltreatment (53, 54), early personality disorders (54) and cannabis use may be synergistically interacting risk factors for psychosis (53, 55) we could not control for early cannabis use and personality traits given these were not recorded.

Interestingly, sexual abuse was not associated with psychotic-like experiences and psychosis. Methodological issues including the under reporting of sexual abuse to child protection authorities (56) due to secrecy (57), the invisible nature of the scene (58), victim's feelings of guilt and shame about disclosing sexual abuse incidents (59) may artificially underestimate the prevalence of this form of maltreatment in this study. On the other hand, it may be that given the greater severity of sexual abuse over other forms of child maltreatment (57, 60), reporting leads to early intervention, so minimising subsequent harm (57) and resulting in the observed weak association.

The underlying mechanism linking child maltreatment with later mental health still remains unclear. One possible explanation is that exposure to child maltreatment in those with underlying genetic vulnerabilities (5) may increase risk of psychosis (61, 62). Additionally, child maltreatment may affect neurobiological pathways involved in stress regulation, such as hypothalamic-pituitary-adrenal axis (63) leading to cortisol dysregulation (64) and heightened stress sensitivity in adulthood (65). Thus, in turn, this may predispose to psychotic symptoms and psychotic disorders (66). Child maltreatment may also have an effect on brain structure and function (67, 68) leading to a range of neurobiological psychopathologies (69-71). For instance, limbic irritability leading to epileptiform activity has been observed in people with a history of maltreatment (72). The picture is complicated by the finding that behaviour problems in childhood and adolescence may also be

antecedents for both child maltreatment and psychosis (4, 14), which is consistent with our finding that early problem behaviours at 5 and 14 years of age, as well as later social deprivation, were independently associated with psychosis.

In summary, emotional abuse, neglect and co-occurring multiple forms of maltreatment are associated with later psychotic experiences and disorder. The findings have important implications for the prevention and treatment of both child maltreatment and psychosis. Effective prevention and early intervention for child maltreatment may prevent psychosis. Provision of parenting skills training and supporting vulnerable families can reduce the risk of child maltreatment and its associated adverse mental health outcomes (73). In the provision of those with psychotic disorder, it is important clinicians screen for child maltreatment (7). Finally, in those exposed to child maltreatment, health professionals and carers should maintain an increased index of suspicion for incident psychosis so that care can be provided in the earliest stages of morbidity.

Conclusion

Emotional abuse, neglect, and co-occurring multiple forms of child maltreatment are associated with both psychotic experiences and psychotic disorders in later life. The association is independent of multiple factors that might have plausibly mediated the relationship. Further research into the mechanism underpinning the association between childhood maltreatment and psychosis outcome is warranted.

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Chapter Six – Childhood Maltreatment and Physical Health Outcomes

Childhood maltreatment and height stunting

Published manuscript (click here to access full length article) and cited as:

Abajobir AA, Kisely S, Williams G, Strathearn L, Najman JM. Height deficit in early adulthood following substantiated childhood maltreatment: a birth cohort study. Child Abuse Negl. 2017;64:71–8.

Objective: This study was designed to examine the association between confirmed cases of childhood maltreatment and reduced growth in young adulthood.

Abstract

Early life stress including childhood maltreatment has been associated with reduced head circumference and/or brain size, cognitive, and academic deficits in children and adolescents. However, little is known about the effect of childhood maltreatment on height, especially in early adulthood. This study was designed to examine the association between confirmed cases of multiple or subtypes of childhood maltreatment and stunted growth in young adulthood controlling for perinatal and familial confounding factors. A total of 2661 (48.4% female) young adults from the MUSP had data on standardised height-for-age score measurement as part of physical assessment at the 21-year follow-up. Prospectively substantiated cases of childhood maltreatment, 0–14 years of age, were linked to the MUSP dataset. Multiple regression analyses were performed to determine the effects of childhood maltreatment on height in young adults. Childhood physical or emotional abuse and neglect were significantly associated with a deficit in height in young adulthood after controlling for perinatal and familial confounders. Multiple incidents of childhood maltreatment also were associated with a deficit in height.

Keywords: substantiated childhood maltreatment, height deficit, young adulthood, cohort study

Introduction

Early life stress including childhood maltreatment has the potential to adversely affect long-term health and physical development, possibly through neurobiological and epigenetic mechanisms (1). For instance, the number and type (2) of childhood maltreatment (3), particularly neglect (4-9), has been associated with a smaller head circumference (2, 4, 9) and reduced brain size (3, 5), as well as cognitive and academic deficits (3, 4, 6, 7). Environmental stress including psychosocial stress (10) such as family conflict, poor housing, low social class (11) and being an orphan child (12) may also affect physical growth (i.e., length or height) (10). However, little is known about the long-term effect of childhood maltreatment on height, especially into early adulthood.

In the short-term, childhood maltreatment including substantiated physical abuse or neglect has been associated with short height-for-age in early childhood (13). In the few longitudinal studies to date, foster care placement for neglect, emotional and physical abuse was associated with height deficit in early childhood period (2, 9, 14). It also appears that maltreated children attain lower levels of physical growth than their nonmaltreated counterparts. However, these findings may have been limited by a short follow-up period that precluded *catch-up growth* (15). As such, the findings may not reveal long-term growth deficits that persist into young adulthood or beyond. In a rare long-term study that extended its follow-up up to 45 years, childhood neglect at 7 years was associated with shorter height throughout childhood in both genders with modest but also significant deficits in adulthood (16). Shorter leg length accounted for the majority of the deficits in males. This study, however, reported no association between sexual, physical or emotional abuse and shortened stature.

The relation between childhood maltreatment and physical and cognitive growth may be complicated. For instance, children with developmental delay have higher rates of childhood maltreatment (17). In addition, some of the perinatal factors associated with lower child growth are also associated with childhood maltreatment (17). These include gender at birth (4), LBW (4, 18), small for gestational age, *nonorganic failure to thrive* (18) and cognitive delay (4). It is also possible that children who are small for gestational age or experienced growth restriction in utero may never reach the height of normal children, so contributing to the disparity in adult height. Also, *failure to thrive* can be the stated reason for hospital admission for childhood maltreatment (18).

The interaction of gender and environmental stress, including childhood maltreatment, on long-term growth consequences is less studied. For instance, it has been suggested that males and females may experience differing patterns of exposure and response to prenatal or postnatal stresses, partly due to different responses to intervention, gender-selective treatment and *catch-up growth* (e.g., faster in

females) (19). However, few of the available studies consider gender while examining the association between childhood maltreatment and height deficit, especially in young adulthood. In terms of other relevant factors, breastfeeding protects againstboth childhood maltreatment (20, 21) and growth deficit (22), possibly as a marker of greater commitment to the child. On the other hand, early cognitive deficit may lead to childhood maltreatment (7) while institutionalisation for childhood maltreatment is reported to be a risk factor for developmental delay (21). In keeping with these findings, children with a history of both childhood maltreatment and *failure to thrive* have more developmental problems including worse cognitive performance and school functioning (23).

Parental factors are also relevant in the development of *nonorganic failure to thrive* (17, 24), as well as cognitive (4), length (17), height (25) or growth deficits in infancy (17) and adulthood (16). These include maternal or parental short stature (< 160 cm) (24, 26), younger age (< 20 years) (4, 17), lower education level, marital status (4) and prenatal smoking (16). These children also have higher rates of agency-recorded childhood maltreatment (4, 17). This may imply that abuse and *failure to thrive* share common risk factors such as family impoverishment (27) and socioeconomic disadvantage (26, 28), which also have been associated with childhood maltreatment (28) and substantial deficits in height growth (26).

One limitation of the existing literature is that any association between maltreatment and height deficits in childhood may reflect an acute or temporary growth failure that may not persist into adulthood. This study was therefore designed to examine the association between confirmed cases of multiple or subtypes of childhood maltreatment and reduced growth in young adulthood controlling for gender–childhood maltreatment interaction, perinatal, and familial confounding factors.

Methods

Data sources

Data for this study were taken from an Australian prospective birth cohort study–the MUSP. The MUSP recruited pregnant women visiting Brisbane's Mater hospital for prenatal care from 1981–83. The cohort comprised a total of 7223 singleton mother-child pairs. Data were collected from mothers' reports at 3–5 days postpartum and again when the child was 6 months and 5 years. Data were also collected from mothers and adolescents/young adults at 14 and 21 years (29). At the 21-year follow-up, 2661 (48.4% female) young adults provided data on their height measurement as part of physical assessment. Government agency-substantiated cases of childhood maltreatment between the age of 0 and 14 years were linked to the MUSP dataset.

Measures

Childhood maltreatment

The present study used state-wide child protection agency records of suspected cases of childhood maltreatment by the primary care giver and/or other perpetrators up to the age of 18 years. There is a policy of mandatory reports of suspected childhood maltreatment cases to the DFYCCQ by medical practitioners and the general public. Childhood maltreatment was substantiated when there was "reasonable cause to believe that the child had been, was being, or was likely to be abused or neglected." Sexual abuse was defined by the department as "exposing a child to, or involving a child in, inappropriate sexual activities." Physical abuse involved "any nonaccidental physical injury inflicted by a person who had care of the child." Emotional abuse was defined as "any act resulting in a child experiencing any kind of emotional deprivation or trauma." Finally, substantiated neglect encompassed a "failure to provide conditions that are essential for the healthy physical and emotional development of a child", incorporating both dimensions of physical and emotional neglect (30). There were also records of the number of maltreatment notifications and substantiations. Both notified and substantiated childhood maltreatment data were anonymously linked to the MUSP dataset (20). This study used substantiated cases of childhood maltreatment (*no/yes*), restricted to those confirmed cases between 0–14 years of age. Overlapping (31) and specific (32) forms of childhood maltreatment substantiations were used to predict an outcome (31, 32) in the study. To test for the independent effects of each form of maltreatment, a composite variable that excluded a specific childhood maltreatment type in a particular model was created and adjusted for. The study also examined the effect of the number of childhood maltreatment substantiations on the outcome.

Height at 21 year

Height of the young adults' was measured using a portable stadiometre at the 21-year follow-up (to the nearest cm) by trained personnel using an age standardised protocol as part of physical health assessment. Height was expressed as standardised height-for-age score.

Perinatal confounders

At birth, the child's gender (*male/female*) was recorded. Information on gestational age was obtained from the coded neonatal obstetric record taken by a midwife at FCV and recorded as *normal* (> 36 months) versus *premature* (≤ 36 months) at birth. Birth weight was measured at birth to the nearest gm and taken from obstetric records. This variable was dichotomised *normal* (≥ 2500 gm) and *LBW* (< 2500 gm). Additionally, mothers were asked for how long they had breastfed their children at 6 months postpartum and were recorded as those didnot breastfeed at all, 2 weeks, 3–6 weeks, 7

weeks–3 months, 4–6 months and until 6 months. The latter 5 categories were combined and the variable was recoded as *ever breastfed* versus *never breastfed*.

Maternal/paternal confounders

Mothers reported their age at FCV and this was categorised into *20+* versus *13–19* years. The height of mothers was measured and recorded to the nearest cm at FCV, as well as mothers were asked to report their partners' heights to the nearest cm. Data on maternal prenatal and postnatal cigarette smoking was obtained at FCV and 6 months postpartum. Information on the frequency of cigarettes smoked per previous week and number of cigarettes smoked per day were collected at pregnancy and 6 months postpartum. The former was recoded as not smoke cigarette at all = 0; once or so = 1; every few days = 2; and every day = 3 whereas the latter as nil = 0; 1–9= 1; 10–19 = 2; 20–29 = 3; and 50+. A dichotomised composite variable was created from the frequency and number of cigarettes smoked and coded as *nil smokers* and *light to heavy smokers*. Similarly, mothers reported family income from pregnancy to 5-year follow-ups. The mean income of each phase was used to measure the adequacy and persistent low income over early childhood period. This was dichotomised as *mid-to-high income* versus *consistent poverty*, on the bases of estimates of 1981–83 poverty level (33).

Analyses

To determine whether complete and non-complete cases differed across confounding variables, attrition analyses using binary and multiple logistic regressions were conducted. Overall, analyses were conducted for the male-female combined sample. Differences between confounders on childhood maltreatment (*no/yes*) and height were assessed using chi-square (categorical variables) and T-tests (continuous variables) analyses. Analyses of variance were used to compare differences in confounders and childhood maltreatment against standardised height scores. Multiple regression analyses were performed to determine the specific effects of each type and/or combination of different types of childhood maltreatment on height including all confounders simultaneously. The final model included a composite childhood maltreatment variable that was created excluding a specific type in a particular model with subtypes of childhood maltreatment to test for independent association. Individual two-sided T-tests *p*-values (< 0.05) were compared for each model to determine whether childhood maltreatment was more likely associated with deficit in height. Finally, gender–any childhood maltreatment interaction term was included in the models to predict the outcome. All beta values presented are standardised regression coefficients. Finally, weighted analyses with IPW (34) were used from the complete cases (35) to determine whether selection bias due to incomplete cases has affected the findings.

Results

The distributions of variables used in this study are presented in Table 1. Height measurement was obtained from 2661 young adults (48.4% female) at the 21-year follow-up. There were significant differences in confounding factors among complete and incomplete cases. Younger maternal age, maternal prenatal and postnatal cigarette smoking, family poverty and change of maternal marital status predicted incomplete cases. Substantiation to childhood maltreatment was associated with incomplete cases as well.

Prematurity, $\chi^2(1) = 7.32$, $p = 0.007$, LBW, $\chi^2(1) = 17.79$, $p < 0.0001$, and never breastfed, $\chi^2(1) = 10.21$, $p = 0.001$, were the perinatal variables associated with any childhood maltreatment. The rate of any childhood maltreatment was higher for children of younger mothers, $\chi^2(1) = 27.62$, $p < 0.0001$, who reported prenatal and postnatal cigarette smoking, $\chi^2(1) = 32.94$, $p < 0.0001$, were living in family poverty, $\chi^2(1) = 8.45$, $p = 0.004$, and changed their marital status, $\chi^2(1) = 36.62$, $p < 0.0001$. Similarly, these variables were associated with the number of substantiations of childhood maltreatment.

There was a gender difference in height score. Males were taller than females, $t(2135) = 48.27$, $p < 0.0001$. The height score was significantly lower in those who had lower birth weight, $F(4.51)$, $p = 0.0339$, and were never breastfed, $F(9.89)$, $p = 0.0017$. Likewise, maternal, $F(201.86)$, $p < 0.0001$, and paternal, $F(110.25)$, $p < 0.0001$, height at pregnancy predicted offspring height.

There was a significant association between the number of substantiations of childhood maltreatment and height deficit after controlling for perinatal and familial confounders. The same applied for the occurrence of all the subtypes except sexual abuse (Table 2). That is, each additional exposure to physical or emotional abuse and neglect, as well as experiencing multiple incidents before the age of 14 years was associated with a 0.03 cm decrease in the mean height of young adults (Table 2). Inclusion of gender–any childhood maltreatment interaction term in the models did not significantly change the magnitude and direction of the findings. Finally, analyses of the weighted data did not show significant selection bias due to incomplete cases (Tables not indicated).

Table 1. Details of distribution of variables used in the study, Brisbane, Australia.

Variables	n	%	Mean (SD)
Perinatal variables			
Gestation age			
> 36 months (normal)	2550	95.8	
≤ 36 months (premature)	54	4.2	
Birth weigh			
≥ 2500 gm	2546	95.7	
< 2500 gm	114	4.3	
Breastfeeding			
Ever breastfed	2085	81.4	
Never breastfed	477	18.6	
Parental variables			
Maternal age at pregnancy			
≥ 20 years	2293	86.2	
13–19years	368	13.8	
Maternal prenatal and postnatal smoking			
Non-smoker	1707	64.7	
Smoker	932	35.3	
Family poverty over the first 5 years			
Adequate income	1610	95.9	
Consistent poverty	69	4.1	
Maternal height at pregnancy at FCV (in cm)	2630		162.9 (6.2)
Paternal height at pregnancy FCV (in cm)	2498		176.7 (7.6)
Offspring height at 21-year (in cm)	2661		171.8 (9.2)
Childhood maltreatment			
Any substantiated maltreatment[a]			
No	2490	93.6	
Yes	171	6.4	
Sexual abuse			
No	2607	97.7	

Yes	54	2.3
Physical abuse		
No	2583	97.1
Yes	78	2.9
Emotional abuse		
No	2570	97.9
Yes	91	3.4
Neglect		
No	2588	97.3
Yes	73	2.7
Frequency of substantiation		
Once only	106	62.0
Twice or more	65	38.0

[a]Any childhood maltreatment included one or more combination of neglect, sexual, physical or emotional abuse.

Table 2. Standardised coefficients of the association between childhood maltreatment and mean height (in cm) at 21-year (n = 2661), Brisbane, Australia.

Childhood maltreatment	**Category**	**Mean height**		
		β	***β*[b]**	***β*[c]**
Any maltreatment	No	1	1	1
Any maltreatment[a]	Yes	-0.04	-0.02	-
Sexual abuse	Yes	-0.05*	-0.01	-0.01
Physical abuse	Yes	-0.03	-0.03*	-0.03*
Emotional abuse	Yes	-0.04*	-0.03*	-0.03*
Neglect	Yes	-0.03*	-0.03**	-0.03**
Number of substantiations	≥ 2	-0.05*	-0.03*	-

[a]Any maltreatment includes one or more combination of sexual abuse, physical abuse, emotional abuse and neglect.

[b]Adjusted for gestational age, gender, breastfeeding, maternal age, maternal smoking, family poverty, maternal and paternal height.

[c]Adjusted for co-occurring forms of childhood maltreatment. $^{*}p < 0.05$; $^{**}p < 0.01$.

Discussion

This is the first study, to our knowledge, of the association between prospectively substantiated specific and independent subtypes of childhood maltreatment, as well as number of substantiations to childhood maltreatment and height deficit adjusting for a range of perinatal and familial confounders. The study found that physical or emotional abuse and neglect, as well as multiple incidents of childhood maltreatment were associated with modest but statistically significant height deficits at the age of 21 years. The use of substantiated cases may reflect chronic effects of childhood maltreatment on persisting height deficit despite access to some available interventions.

Maltreated children continued to experience a deficit in adulthood height. In the case of neglect, this height deficit may be attributed to a lack of access to proper care and nurturing (36) through to the deprivation of basic needs including food. This may involve a lesser level of primary caregiver's bond (37) or under nutrition (38). The deficit in height may also partially be due to the effect of unmeasured third variables associated with *nonorganic failure to thrive* and cognitive delay. Finally, the height deficit may be accounted for short leg length, especially in males (16), although this study did not have a measure for leg length.

The study has important limitations. Higher rates of attrition in substantiated cases of childhood maltreatment may mean the study was underpowered to detect an association for some of the variables, especially sexual abuse. The use of substantiated childhood maltreatment may also reflect more severe cases of maltreatment that may have accounted for the observed height difference. Conversely, the exclusion of notified but unsubstantiated cases may perhaps have led to an underestimate of the actual association, limiting the effect size and its significance. In addition, the causal sequence may be less clear as children with developmental delay may be abused or neglected (15), and the *catch-up growth* may not sufficiently reverse the earlier disadvantages in these children (26). Given the focus on the young adulthood, this study could not control for some late occurring *catch up growth*, although chronically stunted institution-reared children have been observed to experience persistent growth delays (39). The present study also did not include leg length, although short lower limb is common (13), especially in males (16).

Maternal prenatal alcohol (40) or substance use (41) can also be associated with developmental deficits (40, 41). However, although the present study did not adjust for these variables, heavy alcohol (i.e., 1.6%) or illicit drug use in pregnancy was very rare in this sample (42). Finally, the study did not take into account long-term intergenerational increases in height (43), largely explained by improvements in living conditions (44) and better education in families (45).

Given the importance of both childhood maltreatment and developmental delay, these findings have empirical and practical applications. For instance, home visits by a nurse reduce both the risk of childhood maltreatment (46) and poor growth (18, 47). Similarly, nutritional counseling to mothers (18) including breastfeeding (48) and smoking cessation (48) may improve length/height growth (48), as well as motor, cognitive and behavioral development (18, 47). Interventions may also improve longer term outcomes given that poor development in infancy may be associated with higher rates of mortality from cardiovascular and respiratory diseases in adulthood, as well as external causes (49). Finally, foster care may reverse height deficit (50), although this did not have a substantial effect on height deficit in one study of preschool children (2), possibly because of the persistence of childhood maltreatment (51, 52).

Conclusion

The findings confirm the contribution of childhood maltreatment to height deficit in young adulthood. Childhood physical or emotional abuse and neglect predicted height deficits in young adulthood. Multiple incidents of childhood maltreatment were also associated with height deficits.

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Childhood maltreatment and higher dietary intake behaviours

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Abajobir AA, Kisely S, Williams G, Strathearn L, Najman JM. Childhood maltreatment and high dietary fat intake behaviours in adulthood: a birth cohort study. Child Abuse Negl. 2017;72;147–53.

Objective: This study addressed the extent to which substantiated childhood maltreatment, including age at, and number of, substantiations are associated with high fat intake-related behaviours in adulthood and whether there is an interaction with gender.

Abstract

Childhood maltreatment has been associated with a wide range of chronic medical conditions including obesity, other metabolic events and eating disorders. However, little is known about the association between childhood maltreatment and high dietary fat intake. This study addresses the extent to which co-occurring and specific forms of substantiated childhood maltreatment are associated with self-reported high dietary fat intake in adulthood and whether there is a gender–childhood maltreatment interaction in predicting this association. The study also examines the association between age at substantiation of maltreatment, number of childhood maltreatment substantiations and high dietary fat intake-related behaviours. The data were from a prospective Australian pre-birth mother-child dyads study–the MUSP. The study followed 7223 mother-child dyads following the birth of a live, singleton baby at the Mater hospital. Recruitment was early in pregnancy, and then follow-ups at 3–5 days postpartum and again when the child was 6 months, 5, 14 and 21 years of age. The data were linked to agency-substantiated cases of childhood maltreatment 0–14 years. This study extended the data linkage to 3766 (47.4% female) participants who had complete data on dietary fat intake behaviours at the 21-year follow-up. Consecutive logistic regressions were used to estimate ORs with respective 95% CIs for high dietary fat intake for multiple and specific forms of childhood maltreatment, as well as age at, and number of, childhood maltreatment substantiations. Finally, a gender–childhood maltreatment interaction term was used to predict the outcome. In both unadjusted and adjusted analyses, substantiated childhood maltreatment including physical abuse were associated with high dietary fat intake-related behaviours. Similarly, substantiation of childhood maltreatment between the ages of 5 and 14 years was significantly associated with high dietary fat intake-related behaviours as were two or more substantiations of maltreatment. Inclusion of gender–childhood maltreatment interaction only had a minor impact on the size and direction of the association. Chronic and severe forms of childhood maltreatment including physical abuse are associated with a higher rate of dietary fat intake in young adulthood. Further research to replicate this association might focus on possible neuro-hormonal mechanisms that might explain this behaviour.

Keywords: substantiated childhood maltreatment, dietary fat intake, birth cohort study

Introduction

In recent decades, obesity has been a leading risk factor for a number of chronic diseases worldwide contributing to a substantial portion of the disability adjusted life years lost (1). Common modifiable risk factors are associated with an *obesogenic* environment (2, 3). However, there are some specific risk factors with possible epigenetic consequences such as childhood maltreatment (4-9) possibly involving sexual (5-7, 9), physical (6-8) and emotional abuse, and neglect (8). Childhood maltreatment has been associated with obesity (5-7, 9) and subsequent metabolic events (8) in large cross-sectional (6), longitudinal (5, 7) and meta-analytic (4, 8, 9) studies. Obesity in maltreated persons may be considered as a *double* risk factor because it may mediate most of the long-term health problems including metabolic disorders (10-12). However, the association between childhood maltreatment and high dietary fat intake behaviour in young adulthood has not been studied.

In the few available cross-sectional studies, a retrospective recall of a history of sexual (13, 14), physical and emotional abuse, and neglect (8) was associated with a range of eating disorders including anorexia nervosa and anorexia bulimia (8, 13, 14). Other sociodemographic factors including age, lower education (6), lower qualification, unemployment (7), lower income (6) and posttraumatic stress symptoms (15) have been associated with eating disorders and/or obesity (6, 7, 15). However, cross-sectional studies cannot determine which of these factors may be causes, consequences or confounders in the association between childhood maltreatment and food related behaviours. In contrast, in clinical patients, sexual abuse was not found to be associated with anorexia nervosa and anorexia bulimia (16). Furthermore, neither physical inactivity nor cigarette smoking affected the eating behaviour of adolescents with adverse early life experiences (15). These inconsistencies might be due to differences in the research designs and/or characteristics of clinical and community-based participants.

Currently little is known about the effect of childhood maltreatment on high dietary fat intake-related behaviours. Knowing more about the mechanism that may link childhood maltreatment and obesity could lead to targeted interventions (17). However, there have been few such studies (17), especially using a prospective design (7). Available studies have relied on retrospective self-reported childhood maltreatment rather than prospective agency-substantiated maltreatment (18), and it is likely that the former may be subject to recall and social desirability bias. The present study addresses the extent to which co-occurring and specific forms of substantiated childhood maltreatment are associated with high fat intake-related behaviours in adulthood and whether there is an interaction with gender. This study also examines the association between age and number of childhood maltreatment substantiations and subsequent high dietary fat intake.

Methods

Study design and participants

For this study, data from a pre-birth cohort of Australian expectant mothers and their children, in the MUSP, were used. Mothers were enrolled in the study during their FCV from 1981 through to 1983 at Brisbane's Mater hospital. Initially, a total of 8556 pregnant women were approached. A total of 7223 mothers gave birth to a live, singleton baby at the study hospital, who neither died nor were adopted out prior to discharge. The study has followed mother-child pairs until the children attained the age of 21. Mothers were assessed at 3–5 days and 6 months postpartum, as well as at 5, 14 and 21 years of the index child's age (19). The MUSP survey data has been linked to substantiated cases of childhood maltreatment reported to the appropriate government agency up to the age of 14 years. The linkage has subsequently been extended to the 21-year follow-up, which includes details of offspring fat intake behaviours. The current study is based upon of 3766 young adults on whom there were complete data on fat intake at the 21-year follow-up.

Measures

Childhood maltreatment

Suspected cases of childhood maltreatment (including physical, sexual and emotional abuse, and neglect) from 0–14 years of age were identified from state-wide child protection records. Notifications of childhood maltreatment included mandatory reports from medical practitioners and referrals from the general public to FYCCQ. Notified cases of childhood maltreatment were investigated and only the substantiated cases are used for the current analyses. Substantiated cases of childhood maltreatment included those confirmed cases by FYCCQ with evidence of "reasonable cause to believe that the child had been, was being, or was likely to be abused or neglected." The definition of sexual abuse included "exposing a child to, or involving a child in, inappropriate sexual activities." Physical abuse was defined as "any nonaccidental physical injury inflicted by a person who had care of the child." Emotional abuse included "any act resulting in a child's suffering any kind of emotional deprivation or trauma." Finally, childhood neglect was defined as a "failure to provide conditions that were essential for the healthy physical and emotional development of a child." Childhood experiences of *neglect* were intended to include both physical and emotional neglect by those who were taking care of a child (20). Child protection caseworkers determined substantiations of childhood maltreatment including age at, and number of, substantiations (21). The present study uses four hierarchical categories of substantiated childhood maltreatment cases (i.e., sexual, physical and emotional abuse, and neglect) (22) to explicitly examine the associations between each form of childhood maltreatment

and higher fat intake. Given overlaps across subtypes of childhood maltreatment, the study used *multitype* childhood maltreatment model (22, 23) to examine the association between co-occurring multiple types of childhood maltreatment and higher fat intake. Arguably, this classification of childhood maltreatment may have greater predictive validity in substantiated cases of child maltreatment (22). Dichotomised (i.e., *not* versus *yes*) categories of the different forms of childhood maltreatment were used for analyses. Age of occurrence and frequency of childhood maltreatment substantiations were also used to predict the outcome (24, 25). These characteristics reflect chronic exposure to childhood maltreatment and are measures of maltreatment severity (26, 27). The categories included *0–4* versus *5–14* years and *one only* versus *two or more* episodes for age at, and frequency of, childhood maltreatment substantiations, respectively.

Dietary fat intake

The study used 17 items ($\alpha = 0.81$) from the SFQ (28) to assess behaviours related to dietary fat intake. The first 12 items were mainly concerned with frequencies of intake of different types of fatty foods over one week. The items, for example, included: *eat fried food with a batter or bread crumb coating, eat chocolate, chocolate biscuits or sweet snack bars, eat cheddar, edam or other hard cheese, cream cheese, or cheese like camembert,* etc. These were rated on a five-point scale ranging from 1 (never or hardly ever) to 5 (six or more times per week). The remaining five questions were concerned about cooking practices such as trimming the fat off meat or skin off chicken. The latter items included *how is your meat usually cooked?* (1–5 response options), *how do you spread butter/margarine on your bread?* (1–4 response options), *what type of milk do you drink or use in cooking or tea and coffee* (1–5 response options), *how much of the skin on your chicken do you eat?* (1–4 response options) and *how much of the fat on your meat do you eat?* (1–4 response options). The variable consisted of a total score ranging from 17–70. The responses were recoded and summed with *high dietary fat intake* defined as the *top decile* scores, and other scores as *normal*. The SFQ has been validated against the well-established and commonly used Commonwealth Scientific and Industrial Research Organisation food frequency questionnaire (29, 30) while reliability was found to be high in a community sample (28). The questionnaire has been found to be highly correlated with other instruments that assess attitude, behaviour and knowledge of dietary fat intake (28).

Confounders/covariates

The study included two maternal characteristics from pregnancy through to when the child was 5 years old. One was maternal age at FCV (*20+* versus *13–19* years) and the other was family mean income at 4 points from pregnancy to 5 years (*mid-to-high income* versus *consistent poverty*). These

thresholds were based on estimates of the poverty level from 1981–83 (31). The analyses also included 3 child characteristics. These were gender as recorded at birth (*male* versus *female*), and income *($160+* versus *$0–159* per week) and less vigorous physical activity for health fitness, recreation or sport, recorded one item (*no* versus *yes*), at the 21-year follow-up.

Analyses

First, the distribution of childhood maltreatment experiences and other included variables was assessed against high dietary fat intake using descriptive statistics. Second, unadjusted ORs and their 95% CIs of high dietary fat intake were estimated using consecutive binary logistic regressions for each form of childhood maltreatment, as well as age at, and number of, childhood maltreatment substantiations. Third, the extent to which selected confounders accounted for the associations was ascertained by multiple logistic regressions for each model. Finally, the association between gender and any childhood maltreatment interaction was tested. The interaction term was used as there were gender differences in high dietary fat intake from the preliminary analyses.

To account for loss to follow-up, analyses were carried out using IPW (32). Binary and multivariable logistic regression analyses of study variables against loss to follow-up as an outcome (*complete* versus *loss to follow-up*) were employed to identify those variables associated with higher rates of loss to follow-up. Multivariable logistic regression analysis was then used to generate weight for each variable involved in the study. Finally, the analyses included weighted variable in the fully adjusted final models to determine whether loss to follow-up affected the findings.

Results

A total of 3766 (52.1%) participants had complete data on dietary fat intake-related behaviours at the 21-year follow-up. About 47.4% were female. Children of younger and poorer mothers, as well as participants who experienced substantiated childhood maltreatment had higher levels of loss to follow-up. Specifically, 66.8% of participants with any substantiated childhood maltreatment were lost to follow-up. A total of 170 (4.5%) participants experienced any substantiated childhood maltreatment. Of those children exposed to any substantiated childhood maltreatment, 129 (75.9%) children experienced maltreatment in the age group of 5–14 years. Some 65 (32.2%) of children experienced maltreatment two or more times. At the 21-year follow-up, 381 (10.1%) participants reported high dietary fat intake (i.e., *the top decile*). There was a gender difference, $\chi^2(1) = 102.89$, $p < 0.0001$, with females consuming more fatty foods than males. Those young adults who earned $0–159 per week, $\chi^2(1) = 5.17$, $p = 0.023$, had higher rates of fat intake. The likelihood of high dietary fat intake was

significantly greater in those exposed to any substantiated childhood maltreatment, specifically physical abuse (Table 1).

Table 1. Bivariate associations between substantiated childhood maltreatment and high fat intake at 21-year, Brisbane, Australia.

Variables (n = 3766)	High fat intake		
	No, number (%)	Yes, number (%)	χ^2 (df = 1 (*p*-value)
Any substantiated maltreatment[a]			
No	3241 (90.1)	355 (9.9)	5.25 (0.022)
Yes	144 (84.7)	26 (15.3)	
Sexual abuse			
No	3337 (89.9)	375 (10.1)	0.09 (0.770)
Yes	47 (88.7)	6 (11.3)	
Physical abuse			
No	3320 (90.0)	367 (10.0)	5.37 (0.021)
Yes	64 (82.1)	14 (17.9)	
Emotional abuse			
No	3304 (89.9)	370 (10.1)	0.39 (0.529)
Yes	80 (87.9)	11 (12.1)	
Neglect			
No	3322 (90.0)	370 (10.0)	2.01 (0.157)
Yes	62 (84.9)	11 (15.1)	

[a]Any combination of childhood maltreatment included neglect, sexual, physical or emotional abuse.

Exposure to any childhood maltreatment and physical abuse was significantly associated with high dietary fat intake. These associations retained statistical significance even after adjusting for selected confounders. Those who had been physically abused had about two times greater odds of high dietary fat intake. Sexual and emotional abuse, and neglect were not significantly associated with high fat intake (Table 2).

Of those children who were exposed to any childhood maltreatment, those who had experienced childhood maltreatment between the ages of 5–14 years exhibited a greater likelihood of high fat intake. And, the greater the number of childhood maltreatment substantiations, the more the likelihood of high dietary fat. Although weak, these associations were significant and persisted after adjustment for potential confounders (Table 3).

The gender–childhood maltreatment interaction term was significant ($p < 0.0001$) and therefore retained in the model. However, the inclusion of the interaction term in the respective adjusted model negligibly changed the size and direction of the association between any childhood maltreatment and high dietary fat intake (adjusted OR = 1.35, 95% CI: 0.99–1.84, $p = 0.057$). Finally, inclusion of the weighted variable in the adjusted logistic regression model to account for attrition did not affect the direction and magnitude of the association (Table not shown).

Table 2. Binary and multivariable logistic regression associations between substantiated childhood maltreatment and high fat intake at 21-year, Brisbane, Australia.

Childhood maltreatment	Unadjusted OR (95% CI)	Adjusted OR[†] (95% CI)
No any maltreatment	1	1
Any maltreatment[a]	1.65 (1.07–2.54)[*]	1.65 (1.06–2.57)[*]
Sexual abuse	1.14 (0.48–2.68)	1.60 (0.67–3.84)
Physical abuse	1.98 (1.09–3.56)[*]	1.91 (1.04–3.49)[*]
Emotional abuse	1.23 (0.65–2.34)	1.16 (0.61–2.23)
Neglect	1.59 (0.83–3.05)	1.52 (0.78–2.95)

[a]Any childhood maltreatment included one or more combination of neglect, sexual, physical or emotional abuse.

[†]Adjusted for maternal age at first clinic visit, family mean income at 4 points from pregnancy to 5 years, gender at birth, income and physical activity at 21-year.

[*]$p < 0.05$.

Table 3. Binary and multivariable logistic regression associations between age at and number of childhood maltreatment substantiations and high fat intake at 21-year, Brisbane, Australia.

Childhood maltreatment	Unadjusted OR (95% CI)	Adjusted OR[†] (95% CI)
Age at substantiations		
0–4 years	1	1
5–14 years	1.77 (1.09–2.86)[*]	1.77 (1.08–2.89)*
Number of substantiations		
Once only	1	1
Twice or more	1.39 (1.05–1.86)[*]	1.41 (1.05–1.89)[*]

[†]Adjusted for maternal age at FCV, family mean income at 4 points from pregnancy to 5 years, gender at birth, income and physical activity at 21-year. [*]$p < 0.05$.

Discussion

To our knowledge, this is one of the only studies examiningthe relationship betweenchildhood maltreatment and high fat intake-related behaviours in early adulthood. The findings underline the importance of chronic and severe forms of early life childhood maltreatment and later dietary fat. Adjustment for selected confounders including family poverty and physical inactivity did not change the magnitude and direction of the associations, and were unlikely to explain the observed associations between childhood maltreatment and high dietary fat intake. The unadjusted and adjusted ORs were similar with overlapping CIs reflecting similar magnitudes and directions in the associations of childhood maltreatment and high dietary fat intake. It is relevant to note that the gender–childhood maltreatment interaction had minimal impact in predicting high dietary fat. The current study was unable to find a significant association between some subtypes of childhood maltreatment such as sexual and emotional abuse, and neglect, and subsequent fat intake. This study advances the literature by suggesting a consistent association between childhood maltreatment, specifically physical abuse, as well as the age of maltreatment and number of substantiations, and high dietary fat intake.

This study has some limitations. First, there was a higher rate of loss to follow-up for substantiated cases of childhood maltreatment by the 21-year follow-up. This might have contributed to the observed weak association, especially for subtypes of sexual and emotional abuse, and neglect. We attempted to adjust for this possibility using IPW. In addition, the use of substantiated records may not have reflected the actual rates of childhood maltreatment. Substantiated childhood maltreatment may underestimate the true prevalence of childhood maltreatment (33). That is, only some cases of childhood maltreatment come to the attention of government protection agencies. This could have affected the statistical power to detect some associations. The likelihood of misclassifying maltreated children in the comparison group may have diluted the strength of some findings. Thus, this study provides a conservative test of the hypothesis. Furthermore, the current study could not assess the specifics and amounts of nutritional contents of the fatty foods involved and does not reflect clinical cutoffs nor suggest the *etiological* tenet for subsequent obesity. Finally, although longitudinal studies are superior to cross-sectional designs, the current study cannot exclude that in some cases, childhood maltreatment could have been the result of obesity rather than the other way around. However, the choice of fat intake-related behaviours in young adulthood, as opposed to established obesity of indeterminate duration, minimises this possibility.

Although the underlying mechanism is unclear, the high consumption of dietary fats following childhood maltreatment could be explained from a number of perspectives. One possibility is relived

posttraumatic stress symptoms (15, 34). For example, different adverse events in school and family environments including car crashes, sexual abuse, violence, witnessing a death, family crises or stress, and school bullying have been associated with eating unhealthy foods in school-aged adolescents (15). This may partly be due to the palatable nature of high energy-density foods (35) and stress-relieving properties (36) of some food items. The consumption of unhealthy foods including alcohol (15), soft and energy drinks (15, 34), flavoured milk, coffee, fast food, chips and salty snacks, and frozen processed foods (15) may be influenced by their accessibility as a means to cope with underlying stressful conditions (34). Traumatised children may have a tendency to crave these unhealthy foods, especially fatty or sugary foods (15) with subsequent *food addiction* (37, 38) from *emotional eating* as a form of coping (39) and *self-medication* (15) for depression, disappointments and feelings of loneliness (39). Some of the contents of these food items may alter brain chemistry (40) and neuro-adaptive mechanisms (41, 42), resulting in subsequent temporary relief from the symptoms. For example, sexually abused children have reported over eating to cope with emotional distress (43).

It is also possible that eating disorders resulting from childhood maltreatment including the consumption of high fatty foods may reflect a *learned* behaviour to maximise the protective effects of increased body size and/or weight on subsequent abusive events (6). However, the evidence here is speculative and further study on the mechanism of childhood maltreatment, high dietary fat intake and other eating disorders is needed.

This study is the first to assess the association between substantiated childhood maltreatment, as well as the age at, and number of, childhood maltreatment substantiations and high fat intake in adulthood controlling for family and individual level confounders. The use of substantiated cases of childhood maltreatment identified specific and multiple forms of childhood maltreatment (44), and avoided both recall and social desirability bias. The inclusion of the age at, and number of, childhood maltreatment events enabled the assessment of chronic and severe forms of childhood maltreatment and their subsequent impact on high dietary fat, which may mean a continued deterioration of some protective factors (45). The study used validated and structured instruments to assess dietary fat intake. Finally, it prospectively followed study participants into early adulthood so as to assess their behaviours pertaining to high dietary fat intake into adulthood, making it a unique contribution to the literature.

Findings of this study may have implications for health education/promotion and obesity prevention in maltreated children by reducing dietary fat consumption. This particularly applies to cases of physical abuse. Early intervention for *obesogenic* behaviours may be part of primary

prevention efforts, especially for maltreated children. Early intervention for maltreated children may reduce the chance of ongoing development of chronic conditions. As obesity appears to be a consequence of childhood maltreatment, the findings of this study also suggest the importance of preventing obesity via preventing high dietary fat intake. Pre-obesity and/or preclinical trauma-informed care including screening for a history of childhood maltreatment and high fat intake may reduce the development of obesity and its long-term sequalae (17). Indeed, improving our knowledge of modifiable risk factors of obesity may effectively mitigate subsequent long-term effects (4), especially given the relatively less effectiveness of available alternative treatments for obesity (46) and other metabolic conditions. It is also possible that cognitive behavioural therapy for posttraumatic stress symptoms (47) may mitigate high fatintake.

Conclusion

Chronic and severe forms of childhood maltreatment including physical abuse are associated with higher rate of dietary fat intake-related behaviours in young adulthood. Further research to replicate this association might focus on possible biological mechanisms that might explain the perceived benefit of this behaviour.

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Childhood maltreatment, asthma and lung function

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Abajobir AA, Kisely S, Williams G, Strathearn L, Suresh S, Najman JM. The association between substantiated childhood maltreatment, asthma and lung function: a prospective investigation. J Psychosom Res. 2017;101:58–65.

Objective: This study was designed to investigate whether agency-assessed childhood maltreatment was associated with subsequent asthma and lung function.

Abstract

Asthma reflects multiple and likely complex causal pathways. We investigate the possibility that childhood maltreatment is one such causal pathway. Childhood maltreatment can be interpreted as a form of early life adversity and like other life adversities may predict a range of negative health outcomes, including asthma. A total of 3762 young adults (52.6% female) from the MUSP participated in this study. The MUSP is a prospective Australian birth cohort study of mothers consecutively recruited during their FCV at Brisbane's Mater hospital from 1981–83. The study followed both mother-child dyads to the age of 21 years after birth. Participants reported whether they had been diagnosed by a physician with asthma by the 21-year follow-up. Trained research assistants also performed gender- and height-standardised lung function tests using a Spirobank G spirometre system attached to a laptop computer. We linked this dataset with data obtained from the child protection services and which comprised all substantiated cases of childhood maltreatment in the MUSP cohort. Substantiations of childhood maltreatment included children in an age range of 0–14 years. The experience of any childhood maltreatment, particularly emotional abuse, was independently associated with self-reported physician-diagnosed asthma by the 21-year follow-up. The association was no longer significant after adjustment for a range of confounders and covariates in neglected children. Childhood maltreatment, including multiple events, was not associated with lung function in adjusted models. Childhood maltreatment, including emotional abuse, was associated with lifetime ever asthma. This was in contrast tothe absence of an association with objective measures of lung function. More research is indicated on the effect of childhood maltreatment on lung function using objective measures. In the meantime, there should be a greater awareness of the potential impact of childhood maltreatment on the potential to develop asthma, as well as of the possibility that asthma in adulthood may precede childhood maltreatment.

Keywords: substantiated childhood maltreatment, asthma, lung function, longitudinal study

Introduction

Asthma globally is an increasingly common chronic condition (1, 2) with an estimated 100 million new adult cases by 2025 (3). Asthma follows multiple and complex aetiological pathways, which may include in utero (2), environmental (4, 5) and occupational (5) exposures (5). Two meta-analyses of cross-sectional studies, based on self-reported childhood maltreatment in general (6), and physical abuse in particular (7), reported an increased risk of asthma (6, 7), although one reported a nonsignificant association for childhood neglect (7). In addition, the association is less marked for self-reported childhood maltreatment and asthma, as opposed to where there is agency involvement (8).

Findings from two longitudinal studies (9, 10) are equivocal. In one, children with any substantiated and unsubstantiated childhood maltreatment had a 1.73 times higher risk of asthma than nonmaltreated children of similar socioeconomic status (9). Importantly, the more frequent the childhood maltreatment the higher the number of hospital visits for asthma treatment. By contrast, in the other study, a composite measure of childhood abuse and family dysfunction was not associated with asthma (10).

The situation is complicated by the fact that childhood maltreatment and asthma share many risk factors, ranging from biological to the overall psycho-socio-environmental. These include prematurity at birth, LBW (11, 12), breastfeeding (13, 14), an increase in BMI (8), cigarette smoking and mental health disorders (8, 15), as well as younger parental age at birth, poverty (9), low income (9, 16, 17), substance use (16-18), poor housing quality (19) and neighborhood violence (20, 21).

There may also be variation by gender. For example, maltreated females appear to be at higher risk for asthma and other respiratory diseases than males (6, 9, 10, 22). Despite these differences, there has been a little research on the effect of the interaction between gender and stressor(s) on asthma outcomes. However, it is also relevant to note that no gender differences have been found in response to asthma and allergy outcomes in maltreated children (20).

There are also differences depending on whether the outcome is self- or parent-reported or objectively measured through spirometry (23-26). Self-reported diagnoses better predict asthma-related symptoms while spirometrically measured FEV1 percentage predicts asthma severity (23). Interestingly, self-reported asthma symptoms were found to be consistent with physician diagnosis in adults (27).

In conclusion, there are relatively few studies of the physical health impacts of childhood maltreatment (28) including asthma, using psychobiological data from a longitudinal study (29). We therefore used a longitudinal design to investigate whether agency-assessed childhood maltreatment

was associated with a subsequent asthma diagnosis while adjusting for a range of confounders (6, 22) and covariates. We hypothesised that any forms of childhood maltreatment predicted both subsequent asthma and lung function, even after controlling forindividual, familial and environmental levels of confounding and covariation.

Methods

Study participants

The MUSP is a prospective pre-birth cohort recruited from all public patients presenting at the MMMH for their FCV in Brisbane, Australia from 1981–83. A total of 8556 mothers were initially approached and 8458 accepted the invitation, of whom 7223 gave birth to a live, singleton baby (30). We linked these data to agency-substantiated cases of childhood maltreatment (ages 0–14 years). The sample for this study comprised 3762 (52.6% female) with respondent reports of asthma at 21 years of age. A subset of 2642 had also data on lung function.

Substantiated childhood maltreatment

Suspected cases of childhood maltreatment (including physical, sexual and emotional abuse and neglect) up to 14 years of age were identified from state-wide child protection records. Notifications of childhood maltreatment were derived from mandatory reports from medical practitioners, as well as referrals received from the general public. Notified cases of childhood maltreatment were screened, investigated and substantiated by FYCCQ. Substantiated cases of childhood maltreatment included those confirmed cases by FYCCQ with evidence of “reasonable cause to believe that the child had been, was being, or was likely to be abused or neglected.” The definition of sexual abuse included “exposing a child to, or involving a child in, inappropriate sexual activities.” Physical abuse was defined as “any nonaccidental physical injury inflicted by a person who had care of the child.” Emotional abuse included “any act resulting in a child’s suffering any kind of emotional deprivation or trauma.” Finally, childhood neglect was defined as a “failure to provide conditions that were essential for the healthy physical and emotional development of a child.” Childhood experiences of *neglect* were intended to incorporate both physical and emotional neglect by those who were taking care of the child (31). Substantiation of childhood maltreatment was determined by child protection caseworkers of Queensland’s child protection agency. These data were anonymously linked to the MUSP longitudinal database (13). The present study uses exposure to any multiple forms and hierarchical categories of substantiated childhood maltreatment cases (i.e., sexual, physical, emotional abuse, and/or neglect) (32) to explicitly examine the association between each form of childhood maltreatment and asthma, as well as lung function. Maltreated children usually experienced one or more forms of childhood

maltreatment. As a result, we created a composite variable to assess the specific effects of each form of childhood maltreatment, to adjust for possible overlaps. For example, a variable that excluded substantiated physical abuse was created from one or more combinations of sexual abuse, emotional abuse and neglect to adjust for sexual abuse and so on to control for co-occurring forms of childhood maltreatment. Moreover, we used the frequency of recurrent childhood maltreatment substantiations, as proxy indicators of severity, to predict asthma diagnosis and lung function.

Asthma report and lung function

At the 21-year follow-up, participants were asked if they had ever been told by a physician that they had asthma (*no/yes*). A history of physician-diagnosed asthma has been used both in maltreated (8, 16, 19, 20) and large epidemiological surveys (33) to determine asthma prevalence. Trained research assistants also performed gender- and height-standardised lung function tests using a Spirobank G spirometre system attached to a laptop computer based on the American Thoracic Society guidelines (34). Some 3–5 trials were attempted, and the reason(s) were noted on the record sheets if testing was unsatisfactory for any reason. For the purpose of this study, we used FVC, FEV1 and forced expiratory flow, midexpiratory phase ($FEF_{25–75}$). These spirometric values were computed based on all-age reference ranges for spirometry (35).

Early maternal characteristics

We included maternal age and marital status at entry to the study as well as family income as reported by mothers. Age of mothers at pregnancy was recoded as *20+* versus *13–19* years. Their marital status was dichotimised into *married* and *single-separated-divorced-widowed*. Mothers' report of family income was measured from pregnancy through to 5 years (4 follow-ups). The mean income of each phase was taken and dichotomised as *mid-to-high income* versus *consistent poverty*. These thresholds were based on estimates of the poverty level from 1981–83 (36). Data on maternal prenatal and postnatal cigarette smoking were obtained at the FCV and 6 months postpartum as both factors were found to predict later asthma (37). Mothers were asked how frequently they smoked cigarettes in the previous week at both follow-ups and these data were recoded as did not smoke cigarettes at all = 0; once or so a week = 1; every few days = 2; and every day = 3. Respondents were also asked how many cigarettes they smoked per day. The responses were recoded as nil = 0; 1–9= 1; 10–19 = 2; 20–29 = 3; 30–49 = 4; and 50+ =5. A dichotomised composite variable for both prenatal and postpartum cigarette smoking was created from the frequency and number of cigarettes smoked and coded as *nil smokers* and *light to heavy smokers*.

Infanthood characteristics

The child's gender was recorded as male or female as recorded at birth. Gestational age at delivery was recorded as *normal* versus *premature* (< 37 weeks of gestation). Mothers were asked how often their baby had skin problems 6 months postpartum varying from almost every day, a few times a week, a few times a month, rarely and never. This variable was then recoded as *never* and *more frequent*. We also asked if infants were breastfed or not and, recoded the variable into *ever breastfed* and *never breastfed*.

Adulthood characteristics

The height of the young adults was measured to the nearest cm using a portable stadiometre. Similarly, weight was measured as the average of two measures of weight, lightly clothed with a scale accurate to 0.2 kg. We recorded BMI and categorised it into normal weight (< 25 kgm^{-2}) versus overweight (≥ 25 kgm^{-2}) (38).

Self-reported cigarette smoking was obtained at 21 years. Young adults were asked how many cigarettes they smoked in the previous week. Their responses were coded as *no* for nil and *yes* for 1–20+ cigarettes per week. Self-reported internalising problems over the previous 6 months were also assessed using Achenbach's YASR Behaviour Checklist (39) at the 21-year follow-up. The YASR is a self-report designed to measure problem behaviours (39). There were 24 items ($\alpha = 0.92$) for the internalising scale including anxiety, depression and withdrawn. These items were administered to assess internalising with 3 response options: 0 = not true; 1 = somewhat or sometimes true; and 2 = very or often true. Responses were summed up with a higher score representing cases. The study used the top 10% cutoff, and respondents who fall in this cutoff were coded *1* (cases), otherwise *0* (non-cases).

Finally, we assessed participants' neighbourhoods by asking how much the following were a problem in the area where they were living. These included vandalism/graffiti, house burglaries, car stealing, violence in the streets, unemployment, noisy and/or reckless driving, alcohol and drug abuse and school truancy and was assessed using 9 items ($\alpha = 0.81$) rated on five-point scales ranging from 1 (do not know) to 5 (major problem). Responses were summed up with a higher score representing residential problem area and a 10% cutoff was considered to be a high residential problem area and dichotomised into *normal* or *high*. These variables were considered as covariates in our models as they were measured simultaneously with the outcome variables.

Statistical analyses

Preliminary descriptive statistics were used to describe the study variables by asthma status. Five separate binary logistic regression analyses (Model 1) were next used to examine the associations between multiple and single forms of childhood maltreatment and asthma. Then, three progressive sets of multivariable logistic regression models (Models 2 through 4) were developed with each of the specific categories of childhood maltreatment as the main predictor variables and asthma as the main outcome variable, controlling for confounders and overlap of childhood maltreatment step-by-step. The three levels of variables used in progressive multivariable logistic regression were: first, maternal age, marital status, annual family income up to 5 years, maternal smoking at pregnancy and 6 months postpartum; child skin problems and breastfeeding 6 months postpartum. Second, BMI, cigarette smoking, internalising problems and residential problem areas at 21 years were included in the above models. Finally, a composite childhood maltreatment variable that excluded a particular predictor variable of interest in a particular model was included to control for overlaps of different forms of childhood maltreatment. The final model was applied to independently examine the association between specific types of childhood maltreatment and asthma. This model was notapplied for *any maltreatment* group as there were potential overlaps. The above sets of analyses were repeated setting *number of substantiations* as a predictor for the first three models. We chose hierarchical logistic regression analyses to determine the stability of prediction of childhood maltreatment. Maximum likelihood ratio was used to test for model fit. The estimates of the unadjusted and adjusted ORs with 95% CIs of young adults' reports of previous asthma diagnosis were used to present the results with a reference level of *not any maltreatment*. The effect size of ORs was described as small (< 2), medium (2–4) and large (> 4) (40). In the interest of space, discussions of findings are provided for the final fully adjusted model only. Analyses were undertaken for combined male and female samples as there were no gender differences in the prevalence of asthma report, $\chi^2(1) = 1.09$, $p = 0.296$.

Analysis of variance and the F test were used to compare mean values of lung function tests, as well as to examine the bivariate association between childhood maltreatment and lung function tests. The association between childhood maltreatment and lung function tests was estimated using regression coefficients using a series of six multiple linear regressions, adjusting for the above confounders.

Supplementary analyses

Additional analyses were performed to examine the association between childhood maltreatment and report of asthma medication use, following similar procedures. Information on

asthma medication was obtained by asking participants whether they took medication to prevent asthma attacks. The responses were coded as *no* or *yes*. These analyses helped reconcile any differences reported asthma and lung function, as no association with the latter may have meant good asthma control. Conversely, an association between childhood maltreatment and asthma report may reflect a retrospective diagnosis rather than the *current* disease condition.

Lost to follow-up

To account for loss to follow-up, analyses were carried out using IPW (41). Binary and multivariable logistic regression analyses of 8 individual and family level confounders against loss to follow-up as an outcome (*complete* versus *loss to follow-up*) were employed to identify those variables associated with higher rates of loss to follow-up. Then, the multivariable logistic regression analysis was used to generate weight for each variable involved in the study. Finally, the study repeated the fully adjusted final model including the weighted data to determine whether loss to follow-up affected the findings.

Results

A total of 3762 (52.6% females) participants had complete data on asthma with an attrition rate of 47.9% at the 21-year follow-up. Compared to participants, offspring of younger mothers, who were inconsistent poverty and cigarette smokers both during pregnancy and postpartum were significantly more likely to be lost to follow-up. Similarly, those who were never breastfed at the 6-month follow-up had significantly higher rates of attrition. In adjusted analysis, none of these significantly predicted higher rates of attrition. Substantiations to any childhood maltreatment significantly predicted attrition.

There was no significant difference in the proportion of asthma in males and females (15.7% versus 18.2%, $\chi^2(1) = 1.09$, $p = 0.296$). On the other hand, those offspring who had younger, single, divorced or widowed mothers, had smoker mothers, had skin problems, were never breastfed, had higher BMI, higher internalising problem and resided in residential problem areas at 21-year were more likely to report asthma (Table 1). On chi-square tests, childhood maltreatment in general was more likely to be associated with self-reported asthma ($\chi^2(1) = 7.08$, $p = 0.008$), as was emotional abuse ($\chi^2(1) = 8.76$, $p = 0.003$) and neglect ($\chi^2(1) = 9.43$, $p = 0.002$).

There were 130 (3.5%) participants who were exposed to any substantiated childhood maltreatment followed by emotional abuse (n = 62, 1.6%), neglect (n = 52, 1.4%), physical abuse (n = 58, 1.5%) and sexual abuse (n = 42, 1.1%). Exposures to any substantiated childhood maltreatment, emotional abuse and neglect were significantly associated with asthma in unadjusted analyses. The association between any childhood maltreatment and neglect were attenuated when adjusted for

confounders and/or covariates. Specifically, the effect of childhood neglect appeared to be largely attenuated by a higher BMI, cigarette smoking and internalising problems at the 21-year follow-up. Only the association between emotional abuse and asthma report persisted even after adjusting for confounders and co-occurring forms of childhood maltreatment (Table 2). The size of this association was small (adjusted OR = 1.61). Exposure to two or more maltreatment substantiations showed a significant association with asthma, although this was attenuated when adjusted for confounders (Table 3).

Table 1. Description of confounders/covariatesby physician reported asthma diagnosis, Brisbane, Australia.

Variables	n	No asthma	Asthma	χ^2 (df = 1)	*p*-value
		%	%		
Maternal age at pregnancy (in years)					
20+	3270	66.73	33.27		
13-19	492	62.20	37.80	3.92	0.048
Maternal marital at pregnancy					
Married	3446	58.13	33.20		
Single-separated-divorced-widowed	289	66.80	41.87	8.95	0.003
Family income from pregnancy to 5 years					
Mid-high income	2510	66.25	33.75		
Consistent poverty	1056	66.00	34.00	0.02	0.885
Perinatal maternal cigarette smoking					
Nil smokers	2662	68.28	31.72		
Light to heavy smokers	1266	61.93	38.07	15.05	< 0.0001
Gestation at birth					
Normal	3620	66.38	33.62		
Premature	142	59.86	40.14	2.59	0.107
Gender at birth					
Male	1784	66.98	33.02		
Female	1978	65.37	34.63	1.09	0.296
Skin problems at 6 months					

Never	1275	69.80	30.20		< 0.0001
More frequent	2323	63.93	36.07	12.68	
Breastfeeding at 6 month					
Never	2979	67.00	33.00		
Ever	639	62.28	37.72	5.23	0.022
BMI at 21 years					
< 25 kg/m^2	1712	67.93	32.07		< 0.0001
≥ 25 kg/m^2	885	59.77	40.23	17.10	
Cigarette smoking at 21 years					
No	2389	67.18	32.82		
Yes	1353	64.15	35.85	3.54	0.060
Internalising problems at 21 years					
Normal	3345	67.32	32.68		
Case	367	56.40	43.60	17.64	< 0.0001
Residential problem areas at 21 years					
Normal	3379	67.09	32.91		< 0.0001
High	354	56.50	43.50	16.04	

Apparently, the inclusion of an interaction term of gender and any childhood maltreatment did not change the magnitude and direction of the association. Finally, there were no associations between any forms of childhood maltreatment and use of asthma medication (Table not shown).

At the 21 year follow-up, 2615 (51% female) participants had data on spirometry measurements. Males had higher mean scores of FVC than females, 5.37 (SD = 0.81), versus 3.83 (SD = 0.58), t(2613) = 56.26, $p < 0.001$. Similarly, the mean of $FEF_{25–75}$ was 4.54 (SD = 0.66) in males versus 3.33 (SD = 0.45) in females, t(2613) = 54.57, $p < 0.001$. Finally, the mean score of $FEF_{25–75}$ was significantly higher in males than females, 87.30 (SD = 7.02) versus 84.82 (SD = 7.49), t(2613) = 711.00, $p < 0.001$. Sexual abuse was associated with both FVC ($p = 0.004$) and FEV1 ($p = 0.001$).

In both unadjusted and adjusted multiple regression analyses, any childhood maltreatment category including sexual abuse, physical abuse, emotional abuse and neglect, as well as frequency of substantiations were not significantly associated with lung function tests (Tables 4–7).

Table 2. Unadjusted and adjusted odds ratio estimates of the association between childhood maltreatment andasthma at 21-year, Brisbane, Australia.

Childhood maltreatment	Block 1	Block 2	Block 3	Block 4
No any maltreatment	1	1	1	1
Any maltreatment[a, b]	1.44 (1.04–2.00)*	1.32 (0.95–1.85)	1.32 (0.94–1.84)	-
Sexual abuse	1.58 (0.91–2.73)	1.45 (0.83–2.55)	1.45 (0.83–2.55)	1.46 (0.83–2.57)
Physical abuse	1.45 (0.90–2.34)	1.28 (0.79–2.08)	1.29 (0.79–2.10)	1.31 (0.80–2.13)
Emotional abuse	1.71 (1.09–2.69)*	1.60 (1.01–2.54)*	1.61 (1.01–2.54)*	1.61 (1.01–2.54)*
Neglect	1.87 (1.13–3.09)*	1.69 (1.02–2.82)*	1.64 (0.99–2.74)	1.65 (0.99–2.75)

[a]Any childhood maltreatment included one or more combination of neglect, sexual, physical or emotional abuse.

[b]This model was not adjusted for co-occurring forms of childhood maltreatment.

Block 1. Unadjusted childhood maltreatment and asthma at 21-year.

Block 2. Adjusted for Block 1 + maternal age, marital status, annual family income, maternal smoking at pregnancy and 6 months postpartum; child skin problems and breastfeeding at 6 month and residential problem areas at 21-year.

Block 3. Adjusted for Block 1 + Block 2 + BMI, cigarette smoking and internalising problems at 21-year.

Block 4. Adjusted for Block 1 + Block 2 + Block 3 + co-occurring forms of childhood maltreatment.

*$p < 0.05$.

Table 3. Unadjusted and adjusted odds ratio estimates of the association between frequency of childhood maltreatment substantiations andasthmaat 21-year, Brisbane, Australia.

Frequency of substantiation	Block 1	Block 2	Block 3
Frequency of substantiation			
Once only	1	1	1
Twice or more	1.29 (1.03–1.61)*	1.22(0.97–1.53)	1.21 (0.96–1.53)

Block 1. Unadjusted childhood maltreatment and asthma at 21-year.

Block 2. Adjusted for Block 1 + maternal age, marital status, annual family income, maternal smoking at pregnancy and 6 months postpartum; child skin problems and breastfeeding at 6 month and residential problem areas at 21-year.

Block 3. Adjusted for Block 1 + Block 2 + BMI, cigarette smoking and internalising problems at 21-year.

*$p < 0.05$.

Table 4. Unadjusted and adjusted coefficients of the association between childhood maltreatment and lung function in males at 21-year (n = 1282), Brisbane, Australia.

Childhood maltreatment	FVC				FEV1				$FEF_{25–75}$			
	Block 1	Block 2	Block 3	Block 4	Block 1	Block 2	Block 3	Block 4	Block 1	Block 2	Block 3	Block 4
	B (SE)	*B* (SE)	*B* (SE)	*B* (SE)	*B* (SE)	*B* (SE)	*B* (SE)	*B* (SE)	*B* (SE)	*B* (SE)	*B* (SE)	*B* (SE)
No any maltreatment[a]	1	1	1	1	1		1	1	1	1	1	1
Any maltreatment[a, b]	-0.05 (0.11)	-0.05 (0.11)	-0.05 (0.11)	-	-0.04 (0.09)	-0.03 (0.09)	-0.03 (0.09)	-	0.02 (1.06)	0.03 (1.06)	0.03 (1.08)	-
Sexual abuse	-0.04 (0.30)	-0.04 (0.30)	-0.04 (0.30)	- 0.04(0.30)	-0.06 (0.25)	-0.05 (0.25)	-0.05 (0.25)	-0.05 (0.25)	-0.03 (2.84)	-0.03 (2.83)	-0.03 (2.84)	-0.03 (2.84)
Physical abuse	-0.02 (0.16)	-0.02 (0.16)	-0.01 (0.16)	-0.02 (0.16)	-0.03 (0.13)	-0.02 (0.13)	-0.02 (0.13)	-0.02 (0.13)	-0.02 (1.51)	-0.01 (1.51)	-0.01 (1.52)	-0.01 (1.52)
Emotional abuse	-0.02 (0.17)	-0.02 (0.17)	-0.02 (0.16)	-0.02 (0.16)	-0.01 (0.13)	-0.01 (0.13)	-0.01 (0.13)	-0.01 (0.13)	0.02 (1.46)	0.02 (1.45)	0.03 (1.46)	0.03 (1.04)
Neglect	-0.03 (0.17)	-0.03 (0.17)	-0.03 (0.17)	-0.03 (0.17)	-0.01 (0.14)	-0.01 (0.14)	-0.01 (0.14)	-0.01 (0.14)	0.02 (1.58)	0.02 (1.58)	0.03 (1.58)	0.03 (1.58)

[a]Any childhood maltreatment included one or more combination of neglect, sexual, physical or emotional abuse.

[b]This model was not adjusted for co-occurring forms of childhood maltreatment.

Block 1. Unadjusted childhood maltreatment and lung function at 21-year.

Block 2. Adjusted for Block 1 + maternal age, marital status, annual family income, maternal smoking at pregnancy and 6 months postpartum; child skin problems and breastfeeding at 6 month and residential problem areas at 21-year.

Block 3. Adjusted for Block 1 + Block 2 + BMI, cigarette smokingand internalising problems at 21-year.

Block 4. Adjusted for Block 1 + Block 2 + Block 3 + co-occurring forms of childhood maltreatment.

Table 5. Unadjusted and adjusted coefficients of the association between childhood maltreatment and lung function in females at 21-year (n = 1333), Brisbane, Australia.

Childhood maltreatment	**FVC**				**FEV1**				**$FEF_{25–75}$**			
	Block 1	**Block 2**	**Block 3**	**Block 4**	**Block 1**	**Block 2**	**Block 3**	**Block 4**	**Block 1**	**Block 2**	**Block 3**	**Block 4**
	B **(SE)**	***B*** **(SE)**	***B*** **(SE)**	***B*** **(SE)**	***B*** **(SE)**	***B*** **(SE)**	***B*** **(SE)**	***B*** **(SE)**	***B*** **(SE)**	***B*** **(SE)**	***B*** **(SE)**	***B*** **(SE)**
No any maltreatment[a]	1	1	1	1	1		1	1	1	1	1	1
Any maltreatment[a, b]	0.02	0.02	-0.02	-	-0.03	-0.01	-0.01	-	-0.03	-0.03	-0.03	-
	(0.08)	(0.08)	(0.08)		(0.08)	(0.05)	(0.06)		(0.89)	(0.91)	(0.91)	
Sexual abuse	0.03	0.03	0.03	0.03	-0.07	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01
	(0.10)	(0.10)	(0.10)	(0.10)	(0.13)	(0.09)	(0.09)	(0.09)	(1.19)	(1.21)	(1.21)	(1.21)
Physical abuse	-0.01	-0.01	-0.01	-0.01	-0.02	-0.02	-0.01	-0.02	-0.01	-0.01	-0.01	-0.01
	(0.12)	(0.12)	(0.12)	(0.12)	(0.12)	(0.09)	(0.08)	(0.08)	(1.36)	(1.38)	(1.37)	(1.37)
Emotional abuse	0.01	0.01	0.01	0.01	-0.001	-0.006	-0.006	-0.006	-0.03	-0.02	-0.02	-0.02
	(0.12)	(0.12)	(0.12)	(0.12)	(0.12)	(0.08)	(0.08)	(0.08)	(1.39)	(1.39)	(1.40)	(1.40)
Neglect	0.02	0.02	0.02	0.02	0.002	-0.005	-0.006	-0.006	-0.03	-0.02	-0.03	-0.03
	(0.13)	(0.13)	(0.13)	(0.13)	(0.13)	(0.09)	(0.09)	(0.09)	(1.55)	(1.56)	(1.56)	(1.56)

[a]Any childhood maltreatment included one or more combination of neglect, sexual, physical or emotional abuse.

[b] This model was not adjusted for co-occurring forms of childhood maltreatment.

Block 1. Unadjusted childhood maltreatment and lung function at 21-year.

Block 2. Adjusted for Block 1 + maternal age, marital status, annual family income, maternal smoking at pregnancy and 6 months postpartum; child skin problems and breastfeeding at 6 month and residential problem areas at 21-year.

Block 3. Adjusted for Block 1 + Block 2 + BMI, cigarette smoking and internalising problems at 21-year.

Block 4. Adjusted for Block 1 + Block 2 + Block 3 + co-occurring forms of childhood maltreatment.

Table 6. Unadjusted and adjusted coefficients of the association between number of childhood maltreatment substantiations and lung function in males at 21-year (n = 1282), Brisbane, Australia.

Frequency of substantiation	**FVC**			**FEV1**			**$FEF_{25–75}$**		
	Block 1	**Block 2**	**Block 3**	**Block 1**	**Block 2**	**Block 3**	**Block 1**	**Block 2**	**Block 3**
	***B* (SE)**	***B* (SE)**	***B* (SE)**	***B* (SE)**	***B* (SE)**	***B* (SE)**	***B* (SE)**	***B* (SE)**	***B* (SE)**
Once only	1	1	1	1	1	1	1	1	1
Twice or more	-0.05 (0.08)	-0.05 (0.08)	-0.04 (0.08)	-0.04 (0.07)	-0.04 (0.07)	-0.03 (0.07)	0.002 (0.75)	0.01 (0.75)	0.01 (0.76)

Block 1. Unadjusted childhood maltreatment and lung function at 21-year.

Block 2. Adjusted for Block 1 + maternal age, marital status, annual family income, maternal smoking at pregnancy and 6 months postpartum; child skin problems and breastfeeding at 6 month and residential problem areas at 21-year.

Block 3. Adjusted for Block 1 + Block 2 + BMI, cigarette smoking and internalising problems at 21-year.

Table 7. Unadjusted and adjusted coefficients of the association between number of childhood maltreatment substantiations and lung function in females at 21-year (n = 1333), Brisbane, Australia.

Frequency of substantiation	FVC			FEV1			$FEF_{25–75}$		
	Block 1	**Block 2**	**Block 3**	**Block 1**	**Block 2**	**Block 3**	**Block 1**	**Block 2**	**Block 3**
	***B* (SE)**	***B* (SE)**	***B* (SE)**	***B* (SE)**	***B* (SE)**	***B* (SE)**	***B* (SE)**	***B* (SE)**	***B* (SE)**
Once only	1	1	1	1	1	1	1	1	1
Twice or more	0.02 (0.05)	0.02 (0.06)	0.02 (0.06)	-0.03 (0.07)	-0.02 (0.04)	-0.02(0.04)	-0.04 (0.63)	-0.04 (0.64)	-0.04 (0.64)

Block 1. Unadjusted childhood maltreatment and lung function at 21-year.

Block 2. Adjusted for Block 1 + maternal age, marital status, annual family income, maternal smoking at pregnancy and 6 months postpartum; child skin problems and breastfeeding at 6 month and residential problem areas at 21-year.

Block 3. Adjusted for Block 1 + Block 2 + BMI, cigarette smokingand internalising problems at 21-year.

Discussion

To our knowledge, this is the first study to determine the longitudinal association of childhood maltreatment with asthma and lung function in young adulthood using a large birth cohort study that controlled for a range of relevant individual, parental and environmental confounders and covariates. A particular strength of the study is the inclusion of objective measures of both lung function and perinatal adversity including prematurity. We found emotional abuse was independently associated with reports of doctor diagnosed lifetime asthma on fully adjusted models, although the effect size was small (40). The particular association with childhood emotional abuse may suggest impaired cognitive, socioemotional and other developmental pathways (42, 43), which in turn, may be associated with asthma (17, 22). Furthermore, individuals with a history of childhood maltreatment experiences may have an increased risk of *allostatic* overload, which may also be related to somatic complaints and long-term physical health outcomes (28). By contrast, childhood maltreatment was not associated with objective measures of lung function.

Prior longitudinal studies have documented mixed findings (9, 10). In keeping with our study, a cumulative risk of childhood abuse and family dysfunction did not predict asthma in substance rehabilitation patients (10). In contrast, another longitudinal study revealed that modestly risk of asthma in maltreated individuals, suggesting higher service use in severely maltreated (9). Moreover, in keeping with previous studies, most asthma cases in our study were explained by maternal sociodemographic disadvange including younger age (9) and perinatal smoking (16, 17), as well as early allergic conditions and lack of breastfeeding (14). Moreover, the rate of asthma was found to be higher in those with high BMI (44), internalising problems (15) and residential problem areas (20, 21).

Generally, from a life course epidemiological perspective on health, childhood life experiences may influence adulthood health through a trajectory of interconnected biological and social processes (45) that may lead to a number of medical disorders (45, 46) including asthma. Thus, an *ecological* framework (21, 47, 48) encapsulating these risk factors may help understand the possibility of asthma within the maltreating milieu.

On the other hand, this study failed to establish a significant association between childhood maltreatment and objective measures of lung function. One possible explanation is that self-reported asthma may represent ongoing chronic symptoms whereas objective measures record the *current* physical state (23). This is in line with the finding that parent- and self-reported diagnoses better predict asthma-related symptoms than objective measurements (e.g., FEV1%) (23) and, in general, there has been a weak correlation between objective measurements and clinical scores (25, 26). Conversely, this disparity may also be explained by good asthma control at the time of testing,

which may not exclude the presence of subclinical disease (25). Support for this expalanation comes from our supplementary analyses that showed no differences in asthma medication use between participants who experienced, or did not experience, childhood maltreatment.

There are several limitations to this study. The use ofsubstantiated reports may have underestimated the true prevalence of childhood maltreatment (49). This may have contributed to the weak associations especially for sexual and physical abuse. We were unable to control for the effects of early childhood mental health disorders including anxiety and depression (16), or genetic (50) and familial (51) predispositions, which may, in turn, predict later asthma (16, 50, 51). We also could not adjust for the existence of susceptibility genes that predispose chronically stressed youth to asthma (52). Moreover, we could not identify the temporal sequence between childhood maltreatment and early onset asthma as well as whether the asthma was active. This may compromise the longitudinal nature of the findings. Furthermore, self-reports of physician-diagnosed asthma may not pinpoint the exact onset or severity of asthma (20) and are also subject to recall bias and misclassification. Although our supplementary analyses revealed nonsignificant associations for medication use, the study could not screen for possible underlying vocal cord dysfunction, which may co-occur with asthma, overestimating asthma cases and subsequent service use regardless of normal lung function (53). This study could also not identify allergic versus non-allergic (54) and intrinsic versus extrinsic (55), as well as the severity of asthma (56). These distinctions may determine asthma treatment and subsequent prognosis. Finally, day care (57, 58) and exposure to domestic animals (59) were not assessed, which may be either risk or protective factors for asthma depending upon the developmental stage of children (57).

Our findings may have both empirical and clinical implications. Clinicians, community workers and decision-makers need to understand the potential long-term risks of childhood emotional abuse on asthma. The adverse effects of childhood emotional abuse on subsequent asthma underscore the need for concerted public health and clinical interventions including the prevention of childhood maltreatment, as well as individualised treatment for asthma in maltreated individuals. These may include professional home visits in early childhood (60), social support (61) and a stable family environment (62) to mitigate childhood maltreatment and its long-term impact on asthma. Furthermore, multifaceted interventions including discontinuation of maternal perinatal cigarette smoking (63) and enhancing breastfeeding practices (14), as well as maintatining normal BMI (44), treating internalising problems (15) and improving residential areas (20, 21) may decrease the rate of asthma. These conditions may be both risk factors (e.g., maternal smoking (18)) or consequences (e.g.,higher BMI (64) and cigarette smoking (65) of childhood maltreatment. Finally, there is a need to understand more about the *biopsychological* mechanisms of childhood

emotional abuse on subsequent asthma as well as replication of the findings using objective measures of lung function.

In conclusion, childhood maltreatment in general, and emotional abuse in particular, may predict lifetime asthma in young adulthood. Maternal- and/or individual-level confounders and covariates play significant roles in asthma diagnosis, particularly in neglected children. This was in contrast with there being no association with objective measures of lung function. More research is indicated into the effect of childhood maltreatment on lung function using objective measures. In the meantime, there should be a greater awareness of the potential impact of childhood maltreatment on the potential to develop asthma, as well as of the possibility that asthma in adulthood may have been preceded by childhood maltreatment.

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Childhood maltreatment and poor sleep quality

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Abajobir AA, Kisely S, Williams G, Strathearn L, Najman JM. Childhood maltreatment and adulthood poor sleep quality: a longitudinal study. Intern Med J. 2017;47(8):879–88.

Objective: This prospective study was designed to examine the association between substantiated childhood maltreatment and sleep quality.

Abstract

Available evidence from cross-sectional studies suggests that childhood maltreatment may be associated with a range of sleep disorders. However, these studies have not controlled for potential individual-, familial- and environmental-level confounders. This study determined the association between childhood maltreatment and lower sleep quality after adjusting for potential confounders. Data for the present study were obtained from a pre-birth cohort study of 3778 young adults (52.6% female) of the MUSP follow-up. Participants completed the PSQI at the 21-year follow-up. We linked this dataset to agency-recorded substantiated cases of childhood maltreatment. A series of separate logistic regression models was used to test whether childhood maltreatment predicted lower sleep quality after adjustment for selected confounders. Substantiated physical abuse significantly predicted lower sleep quality in males. Single and multiple forms of childhood maltreatment, including age of maltreatment and number of substantiations, did not predict lower sleep quality in either gender in both crude and adjusted models. Not being married, living in a residential problem area, cigarette smoking and internalising were significantly associated with lower sleep quality in a fully adjusted model for the male–female combined sample. Childhood maltreatment does not appear to predict young adult poor sleep quality, with the exception of physical abuse for males. While childhood maltreatment has been found to predict a range of mental health problems, childhood maltreatment does not appear to predict sleep problems occurring in young adults. Poor sleep quality was accounted for by concurrent social disadvantage, cigarette smoking and internalising.

Keywords: childhood maltreatment, sleep quality, birth cohort

Introduction

Childhood maltreatment has been found to lead to a range of mental health disorders later in life. For instance, early exposures to sexual (1-4), physical (2-5)and emotional abuse (1), and neglect (6, 7) predict subsequent internalising and externalising behaviours (6, 7), and depressive disorders in adolescence and adulthood (1-8). Sleep disorder symptoms are often included in measures of depressive disorders. In maltreated people, sleep disorders present in various forms including difficulty falling or staying asleep, sleep disturbances, sleep paralysis, nightmares, insufficient sleep, disruptive nocturnal activity, insomnia (9-23) and overall lower sleep quality (14, 15, 24).

The prevalence of sleep problems ranges from 8.7–59.5% in maltreated people (12, 18, 20, 22) in different study settings, and this wide variation in estimates may be due to differences in study design or types of childhood maltreatment attributable to the various underlying factors (10-12, 17, 18, 20-23). For instance, in retrospective studies, CSA is associated with sleep disturbances (11, 20), more arousals, nocturnal movement and awakenings (20, 23), sleep paralysis (17, 19), nightmares (10) and insufficient sleep (22), particularly in females (13, 21, 25). Similarly, physical abuse has been associated with sleep disturbances (11, 20) such as greater number of awakenings and more movement arousals, nocturnal activity (20, 23), sleep-related violence (26), nightmares (10) and insufficient sleep (22, 23). One or more combinations of sexual, physical and/or emotional abuse have also been associated with higher rates of sleep disorders (11, 15, 27-31) as were emotional abuse and/or neglect (9, 20, 22, 23). Finally, a global score of childhood adversities including childhood maltreatment has also been associated with a range of sleep disturbance (12, 14, 16, 22).

The association between childhood maltreatment and sleep problems may partly reflect the severity, intensity and chronicity of childhood maltreatment (32), where more severe exposure (22), longer duration (25) and age (33) of childhood maltreatment have been found to be associated with severe sleep problems (22, 25, 31-33) including sleep onset latency, restlessness (23) and insomnia (31). These findings may suggest a dose-response relationship between childhood maltreatment and sleep disorders (12, 18, 20, 22, 29, 34).

There are less data on childhood neglect (12, 16, 22, 31) and studies that are available have largely been drawn from clinical (16, 20, 24, 27, 31), postpartum (9) and military (15) settings, and may not be typical of the general population. Moreover, these studies are of adults with sleep disorders giving a retrospective account of childhood maltreatment and may thus be subject to recall bias.

Cross-sectional studies have suggested that maltreated females have higher rates of sleep disorders than males (10, 22, 28). For example, retrospectively self-reported childhood abuse or neglect was related to disturbing dreams, higher levels of nightmares (34) and poor sleep quality in females (24). The difference in nature and severity of childhood maltreatment among genders may account for this difference (35). Females, for example, may experience more instances of penetrative sexual abuse than males, which, in turn, might lead to more severe forms of sleep disorders (35). These women may also have a higher risk of mental health disorders such as depression (34) and dissociation (35) that may potentially lead to sleep disorders (34, 35). On the other hand, there is also a possibility that males with similar exposure may be at higher risk for poor global sleep quality than females (14).

However, not all studies show an association between childhood maltreatment and subsequent sleep disorders (11, 20, 23, 28) suggesting differences in resilience (36) or the impact of other uncontrolled variables that can be causes or consequences of childhood maltreatment. Given these inconsistencies, a longitudinal study using a population sample is needed to improve the overall understanding of this association and investigate any potential gender disparity (37), while addressing all forms of childhood maltreatment and controlling for potential confounders (16, 37).

One longitudinal study so far has investigated a link between substantiated sexual abuse and significant level of sleep disturbances in 78 females after 10 years of victimisation with revictimisation leading to an increased number of sleep problems (38). However, this study was unable to identify possible overlaps of victimisation from different forms of childhood maltreatment and did not control for a number of other potential individual, familial and environmental level confounders.

Potential confounders that need to be considered include sociodemographic characteristics such as age (16, 28), racial origin (28), lower education (12) and marital status (28), all of which may be associated with sleep disorders in maltreated people. Familial life events, financial difficulty (39) and community violence (40) may also be associated with sleep problems. Maltreated children are more likely to live in chaotic environments, which, in turn, may contribute to the development of sleep problems (41). Given the possible contribution of these confounders, prospective studies are suggested (16, 35).

We therefore conducted a prospective study of substantiated cases of childhood maltreatment that used population-based sample to better determine the nature of the association between childhood maltreatment and sleep quality while controlling for potential confounders. Given the wide range of inconsistencies across the literature, it is reasonable to hypothesise that the

association between childhood maltreatment and sleep disorder may reflect uncontrolled confounding.

Methods

Study design and participants

The data for this study were collected as part of the MUSP, a prospective pre-birth cohort study, which recruited a consecutive sample of all women presenting at the MMMH for their FCV in Brisbane, Australia from 1981–83. Of the pregnant women (N = 8556), visiting the study hospital at the baseline, 8458 (98.9%) accepted the invitation. A total of 7223 gave birth to a live, singleton baby and made up the birth cohort. Thus, 7223 comprised the cohort for follow-up (42). The current study comprised offspring with agency-substantiated cases of childhood maltreatment (ages 0–14 years) who reported sleep quality at the age of 21 years. The sample was restricted to 3778 participants (female = 52.6%) who had complete data on sleep quality.

Measures

Childhood maltreatment

Suspected cases of childhood maltreatment were identified from state-wide child protection records. Notifications of childhood maltreatment include mandatory reports from medical practitioners and referrals received from the general public. Reports are screened by the DFYCCQ. Substantiated cases of maltreatment included those cases where the DFYCCQ had "reasonable cause to believe that the child had been, was being, or was likely to be abused or neglected." The definition of sexual abuse included "exposing a child to, or involving a child in, inappropriate sexual activities." Physical abuse was defined as "any nonaccidental physical injury inflicted by a person who had care of the child." The definition of emotional abuse included "any act resulting in a child experiencing any kind of emotional deprivation or trauma." Finally, childhood neglect was defined as a "failure to provide conditions that were essential for the healthy physical and emotional development of a child" and designed to include both physical and emotional neglect (43). Substantiations of childhood maltreatment were determined by child protection caseworkers employed by the Queensland government child protection agency. Age at substantiation and the number of substantiations were also recorded. Data were confidentially and anonymously linked to the MUSP prospective database (44). In this study, substantiated cases of childhood maltreatment were restricted to those occurring between 0 and 14 years of age. Childhood maltreatment events were dichotomised and coded as *no maltreatment* (reference) versus *substantiated maltreatment*. Specific categories of childhood maltreatment included substantiated sexual, physical and emotional abuse, and neglect. This classification appears to have greater predictive validity (45). The study also used age at substantiation (*0–4* years (reference) versus *5–14* years) and the

frequency (*once only* (reference) versus *twice or more*) of childhood maltreatment substantiation to predict outcomes. These characteristics are proxy indicators of childhood maltreatment severity and chronicity.

Sleep quality at 21-year

The PSQI (46) was used to assess subjective sleep quality for the previous month at the 21-year follow-up. The PSQI includes seven parameters of sleep quality including: subjective sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbances, use of sleeping medication and daytime dysfunction, each component scoring 0 to 3 (worst outcome). The seven components ($\alpha = 0.80$) were summed and yielded a cumulative score of 0–21. Based on the PSQI, a cumulative score of *> 5* (34.9%) represents *lower sleep quality* and those participants who score *0–5* (65.1%) are considered to have a relatively *better sleep quality* (reference). The PSQI has reliably detected clinical level sleep problems in adult population across a wide range age groups (47). It is also acknowledged that subjective estimates of sleep quality are a marker of objectively measured sleep quality (48), and there are no differences in subjectively (i.e., using PSQI) and objectively measured sleep quality in maltreated women (24). We also used the top 10% of the study sample with the worst sleep quality scores for further sensitivity analyses to replicate the primary findings.

Maternal socioeconomic status and adversity at first obstetric clinic visit

Maternal age at pregnancy was recorded and recoded as *20+* (reference) and *13–19* years. Family income was assessed at pregnancy and recoded as *≥ $10,400* (reference) and *≤ $10,399*. These thresholds were based on estimates of the poverty level from 1981–83 (49). Mothers' negative or adverse life events at FCV were assessed using 9 items ($\alpha = 0.60$) of the LES (50) that ranged from 0 (no events) to 5 (life events for the last 5 years). Adverse life events included physical illness and various socioeconomic troubles. These items were summed to give a total score ranging from 0–45. Those mothers who reported the upper *10%* of the cumulative score on these life events were recoded having had adverse life events, otherwise *nil* (reference). Paternal or maternal racial origin (*White* (reference)/*Non-white*) were recorded at FCV of mothers.

Sociodemographic characteristics and lifestyles of young adults at 21-year

Sociodemographic characteristics of the young adults including gender recorded at birth (*male/female*), educational level attained (*high school+* (reference)/*incomplete high school*) and marital status (married-living together-separated-divorced-widowed/never married) were collected at the 21-year follow-up. We recoded marital status as *never married* (reference) and *ever married*, the latter category being combined for married-living together-separated-divorced-widowed. The study also assessed environmental or residential problem area by asking if any of the following were problems in the area where they lived: vandalism/graffiti, house burglaries, car stealing,

violence in the streets, unemployment, noisy and/or reckless driving, alcohol and drug abuse and school truancy. These were assessed using 9 items (α = 0.81) rated on five response options and a 10% cutoff was considered to be a *high* perceived problem residential area. Self-reported cigarette smoking and status alcohol use were obtained at 21 years. Respondents were asked how many cigarettes they smoked in the last week. Their responses were coded as *no* (reference) for nil and *yes* for 1–20+ smokes per week. Young adults were also asked how much they drank alcohol and their responses were coded as *abstainer* (reference) and *light–heavy*, acknowledging the continuum of alcohol use (51) and similar alcohol use outcomes, regardless of light versus heavy alcohol use category, in the maltreated children (52). Also, a baseline descriptive analysis did not show significant difference in sleep quality with respect to different levels of alcohol use.

Mental health of young adults at 21-year

The study assessed self-reported internalising and externalising symptoms over the past 6 months using Achenbach's YASR Behavior Checklist (53) at the 21-year follow-up. The YASR is a reliable and validated 54) self-report questionnaire intended to measure psychopathology (53). There were 24 items (α = 0.92) for the internalising scale measuring a combination of symptoms of being anxious, depressed and withdrawn. Similarly, there were 28 items (α = 0.87) for externalising scale, which consists of symptoms of intrusion, aggression and delinquency. These items were administered with 3 response options: 0 = not true; 1 = somewhat or sometimes true; and 2 = very or often true. Responses were summed up with a higher score representing cases. The study used the top 10% cutoffs, and respondents who fall in these cutoff were coded *1* (cases), otherwise *0* (reference group). Depressive symptoms of the young adults were collected by using 20 items (α = 0.88) of the CES-D scale (55) with four response categories ranging from 0 (rarely or none of the time (less than 1 day)) to 3 (most or all of the time (5–7 days)) during the past week at the 21 year follow-up. Individual numbers of symptoms were counted to provide a score ranging from 0–60. A dichotomous variable for depressive symptoms (*not depressed* versus *depressed*) was created using 16+ symptoms cutoff. The CES-D has been validated in apparently healthy adolescents and young adults(56).

Analyses

Descriptive statistics were used to describe study variables by sleep quality at the 21-year follow-up. Seven groups of discrete and multiple forms of childhood maltreatment were examined. The extent to which childhood maltreatment predicted lower sleep quality was tested through a set of separate logistic regression models for each form of childhood maltreatment. First, sleep quality was regressed on each and multiple forms of childhood maltreatment followed by adjustment for individual, family and environmental level factors, as well as cigarette smoking and alcohol use.

Third, subsequent models were developed to adjust for concurrent internalising and externalising problems,as well as depressive symptoms at the 21 year follow-up. We also assessed whether there were relationships between age at, and number of, substantiations, and poor sleep quality. The above set of analyses were sequentially repeated so as to examine the independent prediction of age at, and number of, substantiations subsequently adjusting for individual, familial and environmental factors, as well as cigarette smoking, alcohol use, internalising and externalising problems, and depressive symptoms. Analyses were performed separately for males, females and both genders combined. Adjusted ORs and 95% CIs estimated the likelihood of lower sleep quality with each type and multiple forms of childhood maltreatment, the age of maltreatment and number of substantiationas predictors. Confounders in all models were includedon *a priori* reasoning. Finally, supplementary analyses were performed for the worst 10% of the PSQI scores following the above steps.

Attrition

Bivariate and multivariable analyses of attrition were carried out to identify those variables associated with attrition. To account for attrition, we carried out analyses using IPW (57). We then repeated the multivariable logistic regression analysis to determine weights for each variable involved in the study. Finally, we repeated final fully adjusted models with weighted variable to determine whether attrition changed the magnitude and direction of findings.

Results

At the 21-year follow-up, 3778 (52.3%) participants had complete data on sleep quality. Younger maternal age, lower family annual income, maternal NLEs and non-white racial origin at pregnancy significantly predicted attrition. Among offspring characteristics, being female at birth and experiences of substantiated childhood maltreatment predicted attrition. Lower family annual income and being female remained significant predictors of attrition on multivariable analysis.

Of the included 3778 study participants, 34.9% (n = 1318) had lower sleep quality. Children of younger mothers, $\chi^2(1) = 24.8$, $p < 0.0001$, with reported lower annual family income, $\chi^2(1) = 35.4$, $p < 0.0001$, more NLEs, $\chi^2(1) = 8.4$, $p = 0.004$, and non-white racial background at pregnancy, $\chi^2(1) = 36.1$, $p < 0.0001$, were more likely to have lower sleep quality. Similarly, children who were females, $\chi^2(1) = 151.4$, $p < 0.0001$, had ever married, $\chi^2(1) = 15.1$, $p < 0.0001$, lived residential problem areas, $\chi^2(1) = 18.3$, $p < 0.0001$, had internalising problems, $\chi^2(1) = 84.2$, $p < 0.0001$, externalising problems, $\chi^2(1) = 44.3$, $p < 0.0001$, and depressive symptoms, $\chi^2(1) = 44.3$, $p < 0.0001$, were more likely to experience poorer sleep quality. There was a considerable level of overlap across all forms of childhood maltreatment, of which 171 (4.5%) children had experienced any substantiated childhood maltreatment. Over 1 in 10 (11.6%) maltreated children had lower

sleep quality. Physical abuse only was associated with an increased rate of lower sleep quality in males, χ^2 (1) = 6.6, p = 0.01, but not females, χ^2(1) = 0.02, p = 0.9.

Tables 1 and 2 present the unadjusted and adjusted ORs and 95% CIs of lower sleep quality with each type and multiple forms of childhood maltreatment for males, females and both genders combined, respectively. Physical abuse only was significantly associated with lower sleep quality in males, even after adjustment for a range of confounders. Surprisingly, none of the other childhood maltreatment forms was significantly associated with lower sleep quality in either gender on both crude and adjusted analyses. Being never married, having reported perceived residential problem area, cigarette smoking and internalising at 21 years of age were significantly associated with lower sleep quality in fully adjusted models for male-female combined sample (data not shown).

Table 3 presents unadjusted and adjusted ORs for the association between age at, and frequency of, substantiations of childhood maltreatment and lower sleep quality. None of these characteristics significantly predicted poorer sleep quality. Additional analyses of the extent to which childhood maltreatment predicted worse sleep quality score using the top 10% cutoff did not change these findings (Table not shown).

Table 1. Unadjusted and adjusted ORs of childhood maltreatment predicting poor sleep quality in males at 21-year, Brisbane, Australia.

Childhood maltreatment	Category	Unadjusted OR (95% CI)	Adjusted OR (95% CI)	
		Block 1	Block 2	Block 3
Any maltreatment	No	1	1	1
Any maltreatment[a]	Yes	1.41 (0.84–2.37)	1.34 (0.79–2.28)	1.29 (0.74–2.56)
Sexual abuse	Yes	0.48 (0.13–1.78)	0.45 (0.12–1.74)	0.36 (0.08–1.60)
Physical abuse	Yes	2.94 (1.21–7.11)*	2.72 (1.11–6.65)*	2.63 (1.04 – 6.64)*
Emotional abuse	Yes	2.09 (0.99–4.41)	1.97 (0.92–4.19)	1.80 (0.81–3.99)
Neglect	Yes	1.07 (0.52–2.28)	1.00 (0.47–2.12)	0.99 (0.46–2.19)
Sexual +/- physical abuse	Yes	1.88 (0.91–3.85)	1.76 (0.85–3.65)	1.67 (0.78–3.59)
Emotional abuse +/- neglect	Yes	1.61 (0.88–2.95)	1.52 (0.83–2.81)	1.43 (0.75–2.71)

[a]Any combination of childhood maltreatment included neglect, sexual, physical or emotional abuse.

Block 1. Unadjusted childhood maltreatment and lower sleep quality.

Block 2. Adjusted for Block 1 + maternal age, annual family income, maternal adverse life events and maternal or paternal racial origin at pregnancy; level of education, marital status, residential problem area, cigarette smoking and alcohol use at 21-year.

Block 3. Adjusted for Block 1 + 2 + concurrent internalising, externalising and depressive symptoms at 21-year.

*$p < 0.05$.

Table 2. Unadjusted and adjusted ORs of childhood maltreatment predicting poor sleep quality in females at 21-year, Brisbane, Australia.

Childhood maltreatment	Category	Unadjusted OR (95% CI)	Adjusted OR (95% CI)	
		Block 1	Block 2	Block 3
Any maltreatment	No	1	1	1
Any maltreatment[a]	Yes	0.93 (0.54–1.61)	0.79 (0.45–1.39)	0.71 (0.39–1.28)
Sexual abuse	Yes	0.99 (0.46–2.17)	0.84 (0.37–1.87)	0.85 (0.37–1.94)
Physical abuse	Yes	1.03 (0.45–2.37)	0.85 (0.36–2.00)	0.66 (0.28–1.61)
Emotional abuse	Yes	0.96 (0.44–2.11)	0.79 (0.36–1.78)	0.72 (0.32–1.66)
Neglect	Yes	1.70 (0.59–4.88)	1.39 (0.48–4.08)	1.13 (0.38–3.39)
Sexual +/- physical abuse	Yes	0.94 (0.52–1.72)	0.79 (0.43–1.47)	0.72 (0.38–1.37)
Emotional abuse +/- neglect	Yes	0.87 (0.44–1.72)	0.72 (0.36–1.44)	0.64 (0.31–1.31)

[a]Any combination of childhood maltreatment included neglect, sexual, physical or emotional abuse.

Block 1. Unadjusted childhood maltreatment and lower sleep quality.

Block 2. Adjusted for Block 1 + maternal age, annual family income, maternal adverse life events and maternal or paternal racial origin at pregnancy; level of education, marital status, residential problem area, cigarette smoking and alcohol use at 21-year.

Block 3. Adjusted for Block 1 + 2 + concurrent internalising, externalising and depressive symptoms at 21-year.

Table 3. Unadjusted and adjusted ORs of age and frequency of childhood maltreatment substantiations predicting lower sleep quality in males and females at 21-year, Brisbane, Australia.

Age at and frequency of substantiation	Unadjusted OR (95% CI)	Adjusted OR (95% CI)	
	Block 1	Block 2	Block 3
Males			
Age at substantiation			
0–4 years	1	1	1
5–14 years	1.53 (0.83–2.80)	1.47 (0.79–2.71)	1.45 (0.77–2.75)
Frequency of substantiations			
Once only	1	1	1
Twice or more	1.33 (0.91–1.93)	1.29 (0.88–1.88)	1.24 (0.83–1.85)
Females			
Age at substantiation			
0–4 years	1	1	1
5–14 years	0.84 (0.46–1.54)	0.74 (0.39–1.37)	0.66 (0.35–1.52)
Frequency of substantiations			
Once only	1	1	1
Twice or more	0.98 (0.67–1.42)	0.85 (0.58–1.26)	0.79 (0.53–1.19)

Block 1. Unadjusted age at substantiation and number of substantiation, and lower sleep quality.

Block 2. Adjusted for Block 1 + maternal age, annual family income, maternal adverse life events and maternal or paternal racial origin at pregnancy; level of education, marital status, residential problem area, cigarette smoking and alcohol use at 21-year.

Block 3. Adjusted for Block 1 + 2 + concurrent internalising, externalising and depressive symptoms at 21-year.

Discussion

Overall, we found few significant associations between childhood maltreatment including its severity indicators and sleep problems in adulthood although we did find that exposure to physical abuse predicted lower sleep quality in males. This finding may partially support the argument that childhood maltreatment may predict sleep disorders in males and cancarry equal and/or even higher risk in males than females (14). Interestingly, however, there was a remarkable level of association between concurrent social disadvantage, cigarette smoking and internalising problems, and poor sleep quality in both genders.

These prospective findings are in keeping with several previous retrospective studies. For example, neglect (23, 28), sexual (11, 23) and physical (23, 28) abuse did not show significant association with sleep disorders (11, 28), or other indicators of sleep quality including sleep onset latency, sleep inefficiency, frequent number of body movements and moving time (23). These findings are in contrast with two prior cross-sectional studies that reported a significant association between self-reports of childhood maltreatment and lower sleep quality (24, 29) in epidemiological (29) and clinical (24) samples, as well as a longitudinal study of a clinical sample of sexually abused women (38). Differences in findings may reflect the use of self-reported maltreatment and/or clinical samples as opposed to substantiated reports in a population sample.

The nonsignificant findings of this study suggest that the relationship between childhood maltreatment and poor sleep in early adulthood may be complex. On one hand, childhood maltreatment may lead to a range of mental health problems (6) that could be expected to be associated with poorer sleep quality. For instance, PTSD (9, 13, 15, 19, 32, 38) contributes to difficulties in falling (9, 13), staying asleep (9) and disruptive nocturnal activity (15, 38), as well as sleep paralysis (19) and poorersleep quality (15, 38) in adults maltreated as children. Moreover, depression (13, 15-17, 38), dissociation (10, 17), neuroticism (14), stress (16, 22, 23), alcohol (27) and smoking (22) have been found to be associated with a r ange of sleep disorders. However, the true association may be obscured as many of these disorders can also be a consequence of childhood maltreatment (6, 52). Moreover, adverse life events including an abusive family may lead to sleep disorders (58). Children experiencing maltreatment may deliberately develop a behavioral pattern associated with requiring a change of sleep locations and time (58), which may lead to subsequent sleep disorders. Although it is beyond the scope of our findings, this may be due to disruption and dysregulation of bodily functions with impaired cognitive, emotional and behavior functions (59) in those experiencing childhood maltreatment leading to subsequent use of stimulants (38).

Given the objective assessment of childhood maltreatment from non-clinical participants, we argue that the research design used in this study provides a more valid assessment of the impact of childhood maltreatment on subsequent sleep outcomes. Conversely, prior studies used cross-sectional designs using clinical participants (16, 20, 24, 27, 31) were subject to recall bias and failed to control for a range of confounders. Our findings of nonsignificant associations may also be explained by a number of factors. For example, there may be variations in the type, frequency (60), intensity and duration (61) of childhood maltreatment which may result in varying degree of later outcomes. For example, a combination of retrospective and prospective reports of childhood maltreatment modestly predicted emotional and behavioral problems (62). On the other hand, there are instances in which childhood maltreatment may not be related to more severe forms of mental health disorders (7). Sleep disorders may be part of the latter consequences. Conversely, childhood maltreatment experiences may have subtle effects (63) including sleep disorders. Another possibility may be that relying only on substantiations may underestimate the true prevalence of childhood maltreatment (64), and may falsely underestimate the magnitude of the association. Finally, uncontrolled biological factors including sex hormones may have untoward effect on sleep disorders (65, 66), regardless of childhood maltreatment experiences.

There were some limitations to our study. These included a substantial proportion of loss to follow-up. A considerable number of children who had substantiated maltreatment (n = 341) were lost to follow-up or chose not to complete the sleep quality data, with a possible participation bias to those who had fewer problems including sleep quality. This might have contributed for weaker associations. Some indicators of sleep quality including depth of sleep and how well rested one feels upon awakening (67) were not included in our composite measure. There may also be other risk factors for sleep disorders (16, 39, 41, 68) and, thus, a lack of specificity in these disorders for those who were maltreated may account for the observed nonsignificant findings. In addition, although we adjusted our analyses for psychiatric symptoms by questionnaire, we were unable to include formal psychiatric diagnoses of children in our models. Given a considerable level of variation in regards to later outcomes among the maltreated children, it is also important to consider the effect of possible resilience on sleep quality (36). Finally, the use of subjective sleep quality measures may not comprehensively identify sleep disorders and the underlying pathogenesis. Despite these limitations, findings from this study may indicate that childhood maltreatment may predict poorer sleep quality in some circumstances, namely physical abuse and sleep problems in males. These findings can be used as a preliminary evidence to initiate further longitudinal studies with substantiated childhood maltreatment that controls for early sleep and mental health disorders to replicate the findings. The findings may also help design prevention and treatment of sleep

disorders in maltreated children, especially focusing on underlying or concurrent psychopathology (32).

Conclusion

The current study specifically tested the hypothesis that sleep disorders in maltreated children may be partly or wholly accounted for by underlying confounders. The current longitudinal population-based study has examined the possible association between multiple forms of substantiated childhood maltreatment and subsequently occurring sleep disorders. Childhood maltreatment only appeared to predict poorer sleep quality in the case of physical abuse in males. Poor sleep quality was accounted for by concurrent social disadvantage, cigarette smoking and internalising.

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Chapter Seven – Childhood Maltreatment and Quality of Life

Published manuscript (click here to access full length article) and cited as:

Abajobir AA, Kisely S, Williams G, Strathearn, L, Clavarino A, Najman JM. Does substantiated childhood maltreatment lead to poor quality of life in young adulthood? evidence from an Australian birth cohort study. Qual Life Res. 2017;26(7):1697–1702.

Objective: This study examined the effect of substantiated childhood maltreatment on QoL.

Abstract

This study examined the independent effect of single and multiple forms of substantiated childhood maltreatmenton QoL, controlling for selected potential confounders and/or covariates, and concurrent depressive symptoms. We used data from a prospective pre-birth cohort of 8556 mothers recruited consecutively during their FCV at the Mater hospital from 1981 through to 1983 in Brisbane, Australia. The data were linked to substantiated cases of childhood maltreatment reported to the child protection government agency up to the age of 14 years. The sample consisted of 3730 (49.7% female) young adults for whom there were complete data on QoL at the 21-year follow-up. The mean age of participants was 20.6 years. Logistic regression models were used to assess the association between childhood maltreatment and QoL measured at the 21-year follow-up. There were statistically significant associations between exposure to substantiated childhood maltreatment and poorer QoL. This also applied to the subcategories of childhood physical abuse, childhood emotional abuse and neglect. These associations were generally stable after adjusting for confounders/covariates and concurrent depressive symptoms, except physical abuse. Childhood emotional abuse with or without neglect significantly and particularly predicted worse subsequent QoL. Exposure to any substantiated maltreatment substantially contributed to worse QoL in young adulthood, with a particular association with childhood emotional abuse and neglect. Prior experiences of childhood maltreatment may have a substantial association with subsequent poorer QoL.

Keywords: substantiated childhood maltreatment, quality of life, young adulthood

Introduction

Little is known about the long-term effects (1) of childhood maltreatmenton QoL (2) in young adulthood despite evidence of harm to physical health (3), mental health (4) and psychosocial functioning (5). A recent review of the available cross-sectional studies suggested that all forms of childhood maltreatment have a modest association with a worse QoL, pointing to a dose-response relationship (2). It also suggested there is an overrepresentation of previous CSA in clinical, as opposed to epidemiological samples. This review further recommended a longitudinal study of substantiated cases of childhood maltreatment to test the temporality and directionality of association with poorer QoL (2). This is because cross-sectional studies are subject to recall bias, rumination and help-seeking bias, especially in clinical samples.

A number of factors may be associated with both childhood maltreatment and a worse QoL, thereby confounding the relationship. For example, gender (6), age (7), lower educational achievement (8), youngerage (9) and poverty (10) of parents are potential predictors of childhood maltreatment (7, 8) and are also associated with a lower QoL (8, 11). Moreover, mental health disorders including depression may co-exist with lower QoL (8, 12) in maltreated children. To date, no longitudinal study has yet examined the association between childhood maltreatment and QoL controlling for these factors. We therefore examined a longitudinal population-based study of the effect on QoL of multiple forms of substantiated childhood maltreatment controlling for selected potential confounders and/covariates, and concurrent depressive symptoms.

Methods

Participants

The current study uses data from the MUSP in Brisbane, Australia. This is a prospective pre-birth cohort of mothers recruited consecutively during their FCV at Mater hospital from 1981–83. A total of 7223 mother-child dyads were prospectively interviewed at 3–5 days postpartum and again when the child was 6 months, 5, 14 and 21 years of age (13). The MUSP collected both biological and epigenetic data to explore the general health, growth, development, behaviour and mental health of children, adolescents and young adults, as well as the mental health, lifestyles and parenting patterns of mothers. The MUSP data have previously been linked to substantiated cases of childhood maltreatment reported to the child protection government agency (14) up to the age of 14 years. The current study consisted of 3730 (49.7% female) young adults for whom there were complete data on QoL at 21-year follow-up.

Measures

Childhood maltreatment

Suspected cases of childhood maltreatment from 0–14 years of age were identified from state-wide child protection records. Notifications of childhood maltreatment included mandatory reports from medical practitioners and referrals from the general public to the relevant agency (FYCCQ). Notified cases of possible childhood maltreatment were prospectively investigated by child protection caseworkers, andsubstantiated cases included those with evidence of "reasonable cause to believe that the child had been, was being, or was likely to be abused or neglected." These include sexual, physical and emotional abuse, and neglect (15). We used four hierarchical categories of substantiated childhood maltreatment cases (i.e., sexual, physical, emotional abuse, and neglect) to examine the associations between each form of childhood maltreatment and QoL. Given the overlap among subtypes of childhood maltreatment, we created variables for the following combinations: a) any form of childhood maltreatment; b) sexualand/or physical abuse, and c) emotional abuse and/or neglect (12). In addition, we created composite variables to assess the specific effects of each form of childhood maltreatment. For example, a variable that excluded substantiated sexual abuse was created from one or more combinations of physical and emotional abuse, and neglect to adjust for sexual abuse and so on. Likewise, in multiple forms of childhood maltreatment, those which were not included in a particular category were used to adjust for possible overlaps.

Quality of life

The study used two items asking young adults how satisfied they were with their overall life and how happy they were at that point in time on four scales ranging from very satisfied (1) to very dissatisfied (4), and very happy (1) to very unhappy (4), respectively, at the 21-year follow-up. Additionally, four items from Achenbach's YASR Behaviour Checklist (16) were included to assess QoL over the previous 6 months. The responses to the first two and latter four YASR items were combined to yield an overall QoL index score (Appendix 4, Table 5). The top 10% of the total score represented a *lower* QoL. Self-report of subjective feelings of adults comprise one domain of QoL (8) and have been validated across cultures (17). Similar self-reported items pertaining to different aspects of life including physical health (18) and mood symptoms (19) have been used to measure QoL in adults exposed to childhood maltreatment.

Confounders/covariates

Maternal age and family income at pregnancy werere coded as ≥ *$10,400* and ≤ *$10,399* based on estimates of the poverty level from 1981–83 (20). The analyses also included gender as

recorded at birth, educational level, and receipt of social security benefits for the last six months at the 21-year follow-up (Table 1).

Depressive symptoms of the young adults were collected using 20 items ($\alpha = 0.88$) of the CES-D scale (21). A dichotomous variable for depressive symptoms (*not depressed* versus *depressed*) was created using 16+ symptoms cutoff. The CES-D has been validated in apparently healthy adolescents and young adults (22).

Analyses

Descriptive statistics were used to describe the variables included in the study. Chi-squared statistics were used to determine the associations between study variables. The associations between each and co-occurring forms of childhood maltreatment and QoL were determined, after adjusting for these lected confounders/covariates and a composite variable created from one or more combinations of childhood maltreatment to test for independent effect of each form of maltreatment using consecutive multivariable logistic regressions. Nagelkerke R^2 was used to test for model fit. Finally, to account for missingness, weighted analysis was carried out using IPW (23).

Results

Data on QoL were available for 3730 participants at the 21-year follow-up. Younger maternal age and low family income significantly predicted missing variables on unadjusted analyses. Neither maternal age nor family income predicted missingness on multivariable analyses.

There were a total of 512 (7.1%) substantiations for any childhood maltreatment at baseline, of which 176 (4.7%) were included in the current analyses. Younger maternal age, $\chi^2(1) = 80.5$, $p < 0.0001$, low family income, $\chi^2(1) = 87.2$, $p < 0.0001$, young adults' lower education, $\chi^2(1) = 82.3$, $p < 0.0001$, receipt of social security, $\chi^2(1) = 46.7$, $p < 0.0001$, and concurrent depressive symptoms, $\chi^2(1) = 92.1$, $p < 0.0001$, were associated with childhood maltreatment. There was no difference by gender, $\chi^2(1) = 2.8$, $p = 0.093$.

Female gender, $\chi^2(1) = 36.3$, $p < 0.0001$, younger maternal age, $\chi^2(1) = 6.3$, $p = 0.012$, low family income, $\chi^2(1) = 5.9$, $p = 0.014$, lower education $\chi^2(1) = 9.3$, $p = 0.002$, receipt of social security benefits, $\chi^2(1) = 44.4$, $p < 0.0001$, and concurrent depressive symptoms $\chi^2(1) = 107.7$, $p < 0.0001$, were associated with lower QoL.

There were statistically significant associations between all forms of childhood maltreatment except sexual abuse and lower QoL (Table 1). These associations were also statistically significant for each childhood maltreatment, except for physical abuse, after hierarchically adjusting for confounders/covariates and concurrent depressive symptoms.

Table 1. Associations between specific forms of childhood maltreatment and QoL at 21-year, Brisbane, Australia (n = 3730).

Childhood maltreatment	Group	Nagelkerke R^2	Lower QoL scores	
			Unadjusted OR	Adjusted OR
Any maltreatment	No (n = 3554)	-	1	1
Sexual abuse	Yes (n = 53)	0.38	1.71 (0.97–3.02)	1.49 (0.75–3.12)
Physical abuse	Yes (n = 56)	0.38	2.25 (1.39–3.63)***	1.49 (0.80–2.77)
Emotional abuse	Yes (n = 89)	0.39	2.80 (1.79–4.38)****	2.49 (1.41–4.39)**
Neglect	Yes (n = 71)	0.39	2.82 (1.70–4.66)****	2.86 (1.53–5.36)***

Adjusted for maternal age at FCV, family income at FCV, gender at birth, educational status, receipt of social security benefits and depressive symptoms at 21-year.

***$p < 0.001$; ****$p < 0.0001$.

In terms of combinations of maltreatment, any childhood maltreatment and emotional abusewith or without neglect significantly predicted lower QoL, even beyond and above confounders/covariates and concurrent depressive symptoms (Table 2). Adjusting for confounders/covariates and concurrent depressive symptoms, however, slightly moderated the association between sexual abuse with or without physical abuse and lower QoL.

We found similar results after adjusting for composite variables of childhood maltreatment where each type of maltreatment was excluded in turn (Table not shown). Finally, inclusion of the weighted variable in the adjusted logistic regression model to account for attrition did not affect the direction and magnitude of the association (Table not shown).

Discussion

To our knowledge, this is the first longitudinal study of the association between substantiated childhood maltreatment and lower QoL in adulthood. The findings extend prior cross-sectional findings of strong associations between different forms of substantiated childhood maltreatment and subsequently worse QoL, controlling for potential confounders/covariates, concurrent depressive symptoms and co-occurring forms of childhood maltreatment.

The findings suggest that specific forms of maltreatment including emotional abuse and neglect were independently associated with lower QoL. Similarly, exposure to any form of childhood maltreatment and the number of childhood maltreatment types, particularly emotional abuse with or without neglect, were also significantly associated with worse QoL, suggesting additive effects of childhood maltreatment on QoL. Adjustment for confounders and/covariates, concurrent depressive symptoms and co-occurring forms of childhood maltreatment did not change the magnitude and direction of the associations.

Table 2. Associations between multiple forms of childhood maltreatment and QoL at 21-year, Brisbane, Australia (n = 3730).

Childhood maltreatment	Group	Nagelk-erke R^2	Lower QoL scores	
			Unadjusted OR	Adjusted OR
Any maltreatment	No (n = 3554)		1	1
Any childhood maltreatment[a]	Yes (n = 176)	0.39	2.17 (1.56–3.02)****	2.08 (1.37–3.16)***
Sexual +/- physical abuse	Yes (n = 69)	0.38	1.93 (1.31–2.85)***	1.50 (0.91–2.48)
Emotional abuse +/- neglect	Yes (n = 105)	0.39	3.12 (2.11–4.61)****	3.34 (2.06–5.41)****

[a]Any childhood maltreatment included one or more combination of neglect, sexual, physical or emotional abuse.

Adjusted for maternal age at FCV, family income at FCV, gender at birth, educational status, receipt of social security benefits and depressive symptoms at 21-year.

****$p < 0.001$; ****$p < 0.0001$.

Sexual abuse in isolation was not associated with lower QoL. One possible explanation is it was underreported and so our study was underpowered to establish any association. Conversely, the nature and severity of sexual abuse over other adversities (24) may affect this in that when it is recognised it is more likely to be reported and addressed.

The findings suggest that childhood maltreatment may be directly and independently associated with subsequently worse QoL. This direct association may also be compounded by shared risk factors including sociodemographic disadvantage and poverty, although such people may also balance these adversities with other positive aspects of their lives (25).

In terms of limitations, the inclusion of substantiated childhood maltreatment may have either exaggerated the observed association given these may represent severe cases (2) or minimised them through underestimating the actual prevalence of childhood maltreatment. In other words, there is a possible inclusion of non-reported childhood maltreatment cases in the comparison group that may have diluted the actual associations. This may have also been largely attributed to higher rates of attrition in the substantiated cases of maltreatment in this study (i.e., 34.4%) from the baseline level (14), although attrition has not significantly affected both the exposure and outcome variables of the MUSP study in general (13), and substantiated childhood maltreatment and subsequent outcomes,in particular (5). Second, the QoL measuresdid not differentiate between the

different objective domains of wellbeing, even though childhood maltreatment may have different effects on physical and mental health (12). Lastly, we did not include important variables such as family and social networks that may affect QoL (25).

The findings have empirical and research implications. These may include health promotion, appropriate assessment and access to therapeutic options for maltreated children (26) coupled with designing sustainable programmes across the whole range of lifespan to enhance QoL (27). It is also important to promote resilience through early interventions (28), social support (26) and a stable family environment (29). Finally, there is a need to understand more about the contexts of childhood maltreatment and its subsequent adverse outcomes (30) including lower QoL.

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Chapter Eight – Discussion

This section discusses the general findings of the study, considers some possible mechanisms explaining these findings, presents the strengths and limitations of the study, as well as some implications and future research directions. It also includes a conclusion that highlights the main findings, with some recommendations.

General findings

This study has investigated the long-term consequences of substantiated childhood maltreatment including psychosocial and behavioural functioning, RSBs and adverse pregnancy outcomes, as well as substance use and mental health disorders into the young adulthood, after adjusting for potential confounders and/or covariates. The study finds that childhood maltreatment is associated with impaired physical development and physical health problems. That is, children exposed to specific (76, 102) and multiple (76) forms, and recurrent incidents, of substantiated childhood maltreatment, are at higher risk of a wide range of adverse outcomes including IPV victimisation, delinquency, RSBs and adverse pregnancy outcomes. In addition, maltreated children manifest higher rates of injecting drug and cannabis use disorders, as well as symptoms associated with psychoses as well as psychosis. Adverse physical health outcomes following the experience of childhood maltreatment include a stunting of height, a higher rate of fat intake, poorer sleep quality, asthma and poorer overall QoL. The effect sizes range from small to large (378) and are observed for a wide range of outcomes despite adjustment for potential individual, family and environment level confounders/covariates, across different life spans, and co-occurring forms of maltreatment. Indeed, the adult health consequences of childhood maltreatment appear to be greater than the adult consequences of socioeconomic disadvantage and many other adversities (387).

The findings confirm and extend prior findings. These prior findings generally involve cross-sectional studies revealing strong associations between different forms of childhood maltreatment and what are presumed to be subsequent outcomes. This is the first study, to our knowledge, to test the breadth of impacts of substantiated childhood maltreatment on young adults, using a population-based birth cohort study. The findings extend what is known about the negative health impacts of childhood maltreatment across the early life course of human development. The study replicates and extends some findings from a British cohort of physical development (60, 61) more robustly, with further exploration of a wide range of developmental and health outcomes. The findings are broadly consistent in suggesting that each type of childhood maltreatment is independently associated with negative lifetime developmental consequences (102). Similarly, exposure to multiple forms of childhood maltreatment is associated with worse outcomes (9, 47, 74, 76, 388), with consequences across most spheres of human wellbeing (389, 390).

Unexpectedly, CSA is not associated with any of the outcomes, except physical IPV victimisation, RSBs including early sexual debut in both genders, and higher rates of youth pregnancy in females. There are a number of possible explanations for this weak association. First, the use of substantiated official records (not limited to sexual abuse) may substantially underestimate the actual prevalence of childhood maltreatment generally, and sexual abuse in particular (391, 392). There is a possible exclusion of non-reported childhood maltreatment cases in the affected (maltreated) group that may have diluted the actual associations. This may reduce the precision of estimates and potentially affect the point estimates of associations to some extent. This may be possible as the primary notifications and/or substantiations of maltreatment were for administrative or legal purposes rather than research purposes (393-395). Moreover, the rate of substantiated sexual abuse both in Australian CPS (121) and the study cohort is much lower (for example, it is only up to 0.7% in this study cohort). However, self-reported sexual abuse is 11.3% (nonpenetrative) and 8% (penetrative) in males, and 10.3% (penetrative) and 20.6% (nonpenetrative) in females of the MUSP cohort (11, 30). This is in keeping with the 6% and 17% sexual abuse rate in Australian males and females, respectively (396), and that of 10% severe sexual abuse in England (131). Nonetheless, self-reports of maltreatment (including sexual abuse) are liable to recall bias (104, 131) and may be of less severe exposures (130). Although it is clear that there is underestimation in agency-recorded cases for sexual abuse, we could not test this for other forms of childhood maltreatment due to lack of self-reported data at the 21-year follow-up. Second, secrecy (397), the invisible nature of the scene (398), self-blame, shame and guilt (399), and subsequent under reporting of sexual abuse to child protection authorities (70, 400), both at the individual and *ecological* settings (401), may lead to an underestimate of the prevalence of sexual abuse as a form of maltreatment. Conversely, its unique nature and severity over other types of childhood maltreatment (397, 402) may lead to early interventions that potentially lessen later negative consequences (397, 403), contributing for weak associations. For example, disclosure of sexual abuse is more likely, in females, and may reflect more active reactions in females than males (404). Third, there may be a case where officially documented sexual abuse is less severe than adolescent/adult self-reports (104) due to its varying threshold levels (121). This may mean that substantiated cases may have different outcomes (130). Moreover, although the current study used frequency of maltreatment as potential predictor, it did not have data on severity and chronicity (104, 123). Fourth, prior studies are generally cross-sectional, with a focus on certain outcomes in clinical samples (89-91), and are not generally of representative samples (37, 85, 86). That raises the possibility that sexually abused, severely ill clinical patients turn up for treatment than the general public (405). However, this is a prospective study, exploring a broad range of adverse

health outcomes in young adults following substantiated records childhood maltreatment, controlling for a range of confounders and/or covariates from infancy into adulthood (77). Although outcomes may be similar across subtypes of childhood maltreatment (406), our findings suggest that subtypes of maltreatment may possibly have different and independent outcomes. In contrast, it should be noted that severe sexual abuse is associated with distress and self-blaming, as well as delays in disclosure may lead to severe PTSD (404), irrespective of whether cases are substantiated, unsubstantiated or self-reported (11). Finally, sexual abuse may be more episodic than other forms of maltreatment.

In line with our findings, other researchers have found nonsignificant associations for sexual abuse. These include psychological and behavioural (24, 407, 408) problems, alcohol use, cigarette smoking (15), substance use (14, 201) and mental health disorders (24, 193), as well as poorer physical development (61) and sleep quality (409, 410), asthma (411, 412) and overall poorer QoL (225). Some of these findings have been obtained from the same dataset (MUSP cohort) (14, 15, 24).

Possible explanations of the health impacts of childhood maltreatment

Although an investigation into the possible mechanisms of association is beyond the scope of this study, it is important to consider whether there are mechanisms which might explain why children with a history of childhood maltreatment may disproportionately experience later health problems. The following describe some of the possible explanations.

***Biopsychosocial* model and life course epidemiology**

Although the current study controlled for a range of confounders and covariates, the ongoing complex interactions of multiple unobserved factors (both biological and environmental) with experiences of early childhood maltreatment may be responsible for the observed later adverse consequences. For example, maltreated children possibly lack access to basic positive developmental stimuli across socioemotional, cognitive and physical domains, and at different levels, potentially altering normative functions, consequently leading to later adverse outcomes (413).

Childhood maltreatment may be associated with poor psychoemotional and physical development (164, 165) leading to life course (114) mental and physical health problems (156, 157, 168, 172, 173). This may be attributable to repeated trauma (414), poor competence, maladjustment (415) or due to its *wear-and-tear* (i.e., *allostatic load*) effects on protective mechanisms (63, 416, 417), which, in turn, lead to increased levels of negative consequences (156, 418). These interrelated *biopsychosocial* factors (172) may mediate childhood maltreatment and later outcomes (157). Interestingly, this study reveals multiple impacts of childhood maltreatment (175, 176),

suggesting that maltreated children are at risk of complex comorbidities, spanning different domains, and with multiple impacts of childhood maltreatment (175, 176). This is complemented by the fact that they experience poorer concurrent or later QoL. Although some effect sizes remain small or medium (378) and causal link may be limited, there is a clear evidence suggesting temporally, consistence and causally plausible sequalae of childhood maltreatment (114, 419).

According to *stress sensitisation* and *kindling hypothesis* (169), an increased sensitivity to, and ongoing vulnerability from recurrent episodes of, childhood maltreatment (170, 420) or other controlled and uncontrolled subthreshold level triggers may contribute to these life course outcomes including depression (170) and psychotic experiences (171). Although this study controlled for more recent family- and/or child-related adverse experiences as confounders, their possible consequences were potentially mediated by adolescence stressful experiences (421). Indeed, perhaps maltreatment per se may increase victim's stress sensitisation regardless of both controlled and uncontrolled triggers (169, 422).

Interestingly, a substantial proportion of our maltreated cohort does not develop later adverse outcomes. In the MUSP birth cohort, for example, nearly 66% of those emotionally abused or neglected children experienced IPV victimisation compared to only 34% of children neither emotionally abused nor neglected. Similarly, 30% of maltreated children were found to have cannabis abuse disorder compared to 19% of their nonmaltreated counterparts. Furthermore, only 5.6% and 8.6% neglected and emotionally abused children developed any lifetime DSM-IV psychosis diagnosis. However, these rates are still significantly higher as compared to 1.4% and 1.5% experienced by children not emotionally abused or neglected. This may suggest unmeasured resilience factors that may directly or indirectly affect the development of subsequent outcomes in the maltreated group (93). That is, it should not be ignored that there may be residual impacts of trauma across the life span, with the potential for later outcomes (423). However, the current study has adjusted for a wide range of confounders and/or covariates, based on the *ecological* models (230, 231), to rule out the effect of *trauma spectrum disorder*. Thus, residual confounding may explain these downstream outcomes (423) as it has been suggested that only 10–56% of maltreated children achieve resilient functioning for a wide range of mental health and substance use disorders (131, 424-427). On the other hand, there may also be recovery subsequent to traumatic exposures including maltreatment (428).

Notably, different individuals may perhaps follow different life course trajectories in the face of adversity (428) based on severity and other psychosocial factors. That is, some remain resilient in the aftermath of childhood maltreatment–having competent and functional mental and physical health (429). For example, some people are more vulnerable than equally exposed people

to a risk or *stressor* (233). This can be viewed from *Diathesis-Stress model* or *Differential Susceptibility theory*–that is, underlying maladaptive responses to stress may heighten individual's vulnerability (233, 430) or resiliency (415, 431). In these instances, individuals may be differentially susceptible to, or cope with, or resilient to, a *stressor* due to variations in phenotype, endophenotype or psychosocial coping strategies (430, 432). Flexibility in suppressing or enhancing emotions, as well as positive emotions in the face of adversity are associated with long-term adjustment (429, 433). Variations in individuals' resilience may include sensitivity to context, availability of coping strategies and social feedback (434). These differences may further be due to variations in social functioning and availability of supportive services (435, 436). For example, availability of both familial and extrafamilial coping strategies including better quality parental care, competent peer relations and school success, as well as low levels of depression, PTSD, internalising and externalising symptomatology in maltreated children are associated with lesser later negative effects (131, 424, 425, 435-438). Similarly, from the *biopsychosocial* perspective, biological vulnerabilities and early sociocultural contexts lead some children to adverse outcomes, and that these outcomes may be less severe based on cognitive and emotional functioning (e.g., knowledge acquisition, life skills and social-information-processing pattern) (439). Thus, only a minority of people exposed to potentially traumatic events, including childhood maltreatment, may experience acute or chronic consequences (428, 429) while the majority of the population tend to remain minimally affected by adversity (440). The latter group possibly follows distinct outcome trajectories, ranging from what has been termed *stress inoculation* (441) to resilient or recovery (428). That is, those experiencing traumatic exposures may either maintain an equilibrium with healthy levels of mental and physical functioning or experience subthreshold level symptoms (428). Maltreated children may perhaps experience other forms of psychopathologies that are not measured in this study, such as failed relationships, addictions to gambling, workaholics behaviour, etc. Overall, from the *ecological* model perspective (177-179), both micro- and macro-level factors including childhood environment, individual differences, parental SES and psychopathology, and sociocultural settings may contribute for differential responses to childhood maltreatment.

Although beyond the scope of the current study, it is also relevant to consider differential vulnerability may be due to dysregulation in neural or endocrine systems (233, 430, 437, 442) and variations in genotype (430) of maltreated children. A meta-analytic review reveals some evidence on genetic vulnerability of maltreated children for a range of mental health disorders (443). This may be through the effect of stress on part of the brain involved in memories and self-reflection, and this, in turn, may affect resiliency (444) and genetic susceptibility to PTSD (445), and later outcomes. It is also important to recognise that variation in genes may also determine prognosis for

outcomes of *stress* (446). However, childhood maltreatment may have direct effects on psychopathy independent of some genes, common to both children and their parents (447). That is, gene variants do not determine resilience in the maltreated, rather their influence is detrimental in the nonmaltreated, suggesting maltreatment per se leading to less resilience and later consequences (430, 442, 448). This highlights the need for more epidemiological genetic studies that will help understand resilience from multiple perspectives before adequate and effective policy responses are put in place.

Socioeconomic and early psychosocial disadvantage

Exposure to early adversities in general, and childhood maltreatment in particular, has been associated with maternal/parental poverty (449), poor perinatal lifestyles (61, 81, 249) and potential mental health problems (450), all of which may contribute to offspring adverse health impacts. That is, poor parenting, family poverty and psychopathology have been associated with childhood maltreatment and poor developmental outcomes (93, 451). The impact of these behaviour problems may extend during and beyond the childhood period possibly leading to subsequent poor psychosocial (160), physical and mental health outcomes (36) during adulthood. The WHO and CDC jointly identified parental separation, instability, residential insecurity, violence, arrest, parental substance use and mental illness as biologically and causally plausible, risk factors for adverse offspring outcomes (452). Furthermore, there is evidence of differences in social and economic characteristics of children who have been maltreated (43, 435), and it may be that these differences explain the observed differences in later health outcomes. This perhaps differentiates the *biopsychosocial* model from *social learning theory* (180), where early life experiences are repeated in later stages of life. However, the effects of these factors do not explain the findings of the current study as it adjusts for most of these factors, suggesting the independent impact of childhood maltreatment.

Early conditions such as internalising and externalising problems, aggression and ADHD (255) can be the causes (53, 81, 249, 250, 254), or arguably also the consequences (257-259), of childhood maltreatment. These may be through the effects of childhood maltreatment on psychopathology, particularly PTSD (453). This raises the possibility that PTSD tends to mediate and/or predict the association between childhood maltreatment and later outcomes (57, 163, 454), especially when it is accompanied by other early adverse exposures (455-458). Interestingly, most of these variables were adjusted for in this study and did not appear to account for the observed associations.

Gender differences in childhood maltreatment outcomes

Based on our preliminary analyses to test for gender differences, gender was included as a confounder, separate analyses were done for either gender or some analyses included the interaction term of gender and childhood maltreatment, in addition to the main effect of gender. These analyses were supported either by literature or theory. Interestingly, the study participants experience similar levels of outcomes regardless of gender difference except for some psychosocial outcomes. This study, for example, reveals gender differences such that maltreated males generally appear to be at higher risk of delinquent behaviour. It has been reported that gender interacts with childhood adversities including childhood maltreatment, to impact on externalising (325), antisocial behavior (244), criminality (22, 68) and youth violence (327), especially for males (68). On the other hand, maltreated females are at increased risk of IDU in keeping with other studies that reveal physical (245) and emotional (275) abuse strongly predict cigarette smoking in females but not males (275, 322). This may be due to variations in underlying processes towards the impact of childhood maltreatment. For example, early age of onset of (330), or more exposure to, maltreatment incidents (459), neighbourhood dysfunction (312) and internalising (325) may be responsible for drug use symptoms more often in females than males. That is, greater maltreatment severity in females and underlying internalising symptoms may be related to drug-related problems in females than their male counterparts.

Role differences, characteristic of either gender, may also contribute for the observed differences. For example, it is possible that there is gender bias in detecting childhood maltreatment in male children since they may be more reckless, engage in outdoor activities and sports, that could mask childhood maltreatment at home. This could further explain weak association in males due to less power to detect associations for some outcomes (e.g., IDU). Interestingly, there are no gender differences in experiencing childhood maltreatment in the MUSP cohort, except for sexual abuse, where females are at higher risk than males (Appendix 2, Table 2). Therefore, the observed differences are independent of severity and types of childhood maltreatment in either gender. Similarly, with a small number of maltreated cases in some categories it may not be possible to test for gender differences. Overall, childhood adversities are associated with gender-specific psychosocial outcomes (441), and childhood maltreatment related PTSD, dissociation and managing trauma-related symptoms may contribute to gender differences (329). Conversely, gender differences may be due to the differential impacts of the interaction of uncontrolled biological and psychological factors (324, 460) with childhood maltreatment, possibly affecting the responses (461) and adaptations (462) to maltreatment experiences (463).

Strengths

The long-term follow-up of a population-based children cohort (332) may mean that the findings are generalisable to the population level data. However, although children from Aboriginal background are more likely to be substantiated to childhood maltreatment (153), and overrepresented in the national profile of childhood maltreatment (121), they are underrepresented in the current study (332), and, thus, the findings that childhood maltreatment leads to adverse outcomes could not be generalised to Indigenous Australians in this study.

The use of government-substantiated cases of childhood maltreatment reduces the chance of recall and selection bias (104). The use of prospectively measured, agency-substantiated childhood maltreatment has the advantage of identifying specific numbers and types of maltreatment over self-reported recalls of childhood experiences at later stages of life (130). Childhood maltreatment often co-occurs in the context of complex disadvantages and behavioural problems. Measures on individual and co-occurring forms of childhood maltreatment also enable an assessment across a broad range of outcomes. The investigation of outcomes for multiple forms (103), and repeated incidents, of childhood maltreatment substantiations may be a severe prediction of outcomes (111). There may be a correlation among childhood maltreatment experiences, and these experiences may not be mutually exclusive (51). However, the current study attempted to identify the independent effect of each form of childhood maltreatment by adjusting for other forms of maltreatment. This is to distinguish the sole effect (104, 106) of each form of childhood maltreatment. This is complemented by a representative sample that documented *multitype* childhood maltreatment experiences, accompanied by a strong methodological design (464), to improve the power (103) and control for confounders and/or covariates. Moreover, outcomes were measured prospectively and these measurements were independent of exposure status, using validated tools.

This study also specifically explored the long-term impacts of emotional abuse and neglect. These varieties of childhood maltreatment have been less studied (50). Moreover, we restricted experiences of childhood maltreatment to 14 years of age to determine its temporal relationship with outcomes prospectively measured at the 21-year follow-up so that recency effects are unlikely. The analyses overall revealed consistent independent findings across a range of childhood maltreatment categories, suggesting reliability and validity of both specific and multiple childhood maltreatment measurements.

Limitations

The baseline sample of pregnant women was not randomly selected from the general population (332). Moreover, there was a considerably higher attrition rate in MUSP particiupants of highest risk (386). That is, a substantial proportion of children (66.7–70.1%, n = 341–358) who

were substantiated for childhood maltreatment at baseline level (143) were lost to follow-up at the 21-year. These factors may be associated with possible participation bias. Thus, higher rates of attrition may have affected the statistical power to detect significant associations, especially for sexual abuse. Although there are differences in baseline population, the overall rate of substantiated childhood maltreatment in the MUSP cohort (7.1%) is far less (143) than the rates of childhood maltreatment substantiation both in Queensland jurisdiction (about 35%) and Australia (43%), among children subjected to maltreatment investigations (121). That is, higher rates of attrition in maltreated children may perhaps associated with the loss of children with more severe outcomes (154), and the observed findings, arguably, in the remaining participants, are the reflections of less severe consequences. Although the inclusion of only substantiated cases may have underestimated actual levels of childhood maltreatment (465), sensitivity analyses with IPW analyses did not reveal any bias associated with attrition, and, thus, the significant findings provide reasonable estimates of the *real* associations.

Inconsistent definitions (466), substantiation of childhood maltreatment (9) and biases inherent in official procedures (70) may have been associated with underreporting or undetected cases. These factors may have contributed for the observed weak associations by underestimating some rates, especially in sexual abuse. Although CPS definitions may be similar across Australian jurisdictions (121), there may also be variations between the research definitions (393) and legal definitions of childhood maltreatment (394, 395). Specifically, assessments of CPS tend to focus on a single form of childhood maltreatment and its substantiation may potentially lead to immediate attention by stakeholders (51). There may be variations in the way the criteria are used and applied (51, 146). Also, CPS may prioritise cases based on a perceived hierarchically (i.e., sexual, physical and emotional abuse, and neglect) (76), underestimating emotional abuse and neglect (50). That is, CPS workers may only detect high threshold levels of childhood maltreatment, by neglecting those less easily identifiable. It is rare that CPS records are consistent with retrospective self-reports (57, 132, 134). That said, in this study, sensitivity analyses with unsubstantiated childhood maltreatment revealed similar findings to those observed in substantiated cases.

Our dataset included information on such childhood maltreatment characteristics as relationship to the perpetrator, or type of perpetrator (103), intensity and duration (467), which may be severity indicators (103), and contribute for poor outcomes (206, 468). However, we could not carry out the analyses using these variables because of the small number of cases. Instead, we examined the extent of childhood maltreatment using the age at (135, 136), and subtypes or number of (109), agency-substantiated events (109) to examine outcomes. Also, the combination of retrospective- and agency-reports may more explicitly explore childhood maltreatment and later

impacts, rather than the single use of agency records (130). Although an attempt has been made to restrict maltreatment experiences analyses to respondents 14 years and younger, early childhood and/or pre-exposure to childhood maltreatment outcome status may blur the real causal association. This may be particularly important for outcomes pertaining to asthma, lung function and sleep quality, which also showed weak associations.

Furthermore, there may be cumulative risks (68, 305) that the binary classification scheme of childhood maltreatment, in this study, was not be able to assess. Continuous or ordinal scales might provide better power to explore the effect of such risks. Multiple comparisons may also inflate Type I errors. In other words, the approach of modelling for each type of childhood maltreatment and controlling for co-occurrence of maltreatment by creating composite variables for the remaining types of maltreatment may be subjected to a problem of shared variance. Although recall bias is less liable in a developmentally active, young sample/cohort, this study entirely focusses on outcomes into young adulthood where outcomes may be less overt following maltreatment or *stress* (469). Restriction to younger cohort may also limit generalisability to the older population. Finally, this study did not explore maltreatment occurring in a broader community such as school and child welfare settings, and this might have underestimated both its magnitude and effect. Overall, although longitudinal studies are suggested to be ideal in studying the dynamics involved in recovery (77), the current study could not go beyond the development of prediction models.

Implications of the findings

There is a need to develop a more sophisticated framework for multifaceted risk assessment and comprehensive intervention (68, 77, 114). It is difficult to know how one might lessen victimisation to childhood maltreatment (77), and its consequences (114, 470). As a first step, a structured evidence-based intervention is needed, which considers improvement of family SES and psychopathologies (59, 63, 471), changes in institutional context, as well as ways in which caregivers interact with children (472). Although detailed discussion may be beyond the scope of this study, some of the public health and clinical interventions are briefly presented below.

Improvement of socioeconomic status of families

Appropriate family interventions, including education (473), have been found to lessen childhood maltreatment risk factors (474) as well as the duration and cost of foster care (475, 476). For example, two systematic reviews of randomised trials and/or conventional interventions on home-visiting programmes suggest that prenatal and infancy home-based care may help family provide sensitive and responsive caregiving particularly in early life (< 5 years), and reduce the incidence of maltreatment (474, 477). Early life home-based care has been found to ameliorate later

behavioural consequences perhaps through reducing the level of maltreatment (478). That is, in nurse-home visited families, the level of maltreatment is found to be lesser (479) and that maltreated children experience less early onset behaviour problems compared to their comparison group (478), perhaps through effective family planning coupled with collective economic autonomy (479) or enhanced uptake of intended services (480). Moreover, parent education dealing with child-parent interaction is found to be promising intervention in reducing the incidence of childhood maltreatment (474). For example, the Triple P, foster care placement (403), family and social support in adulthood (63, 108, 471) tend to reduce the impact of maltreatment on early onset problem behaviours (478) and overall poor QoL (108). This may be attained through building strengths, reframing resilience and creating support connections. These interventions may slightly reduce the risk of physical and emotional symptoms as well as behaviour problems (127). It may be that interventions appear to help only a small subgroup of maltreated children (e.g., mean effect among controls = 2.03 versus intervention group = 2.07) (127). That said, individualised interventions, especially for CPS identified cases of maltreatment, are recommended based on unique experiences of the victim children and/or omission patterns by the caregivers (51, 403). This can be achieved by provision of developmentally appropriate information and direct investigation of maltreatment history (399). It is important, however, to recognise that the effectiveness of such interventions in the prevention of all forms of maltreatment tends to be limited and a function of continued training, supervision, monitoring and evaluation of interventions in the target population (403, 481).

Preventing (482), and screening for, childhood maltreatment (483) and subsequent outcomes (e.g., IPV experiences) are found to be some of the most effective ways to prevent DV (482-484)– the commonest risk factor for childhood *revictimisation*. Indeed, there is a substantial overlap between DV and childhood maltreatment (485). In this study, for example, violence at home at the 14-year follow-up significantly increased the risk of substantiation to any form of childhood maltreatment (χ^2 = 61.7, $p < 0.0001$). Conversely, maternal marital stability from birth up to 14 years of age of the index child decreases the rate of offspring victimisation to different forms of IPV by 54–77% at the 21-year follow-up. Up to 38% of Australian children with maltreatment notifications are living in out-of-home care settings, and are cared for by their non-biological parents in 2016 (121). The use of substantiated cases may have led to interventions within our study. The fact that effects are observed despite these interventions (e.g., foster care for maltreated children (403)) is worth noting. Finally, the current study controls for some of these factors (486, 487).

Improvement of psychosocial aspects of families

It is well-established that maternal mental health problems such as perinatal depression, cigarette smoking and alcohol use are associated with substantiated childhood maltreatment, developmental and multi-system negative impacts (16, 83, 106, 239, 249, 264, 287, 289, 308). The latter include ASPD, cannabis use, cognitive deficits, depression and other psychotic symptoms (68, 272, 299-301, 305). These factors may impair provision of some forms of parental care predisposing children to abusive and/or neglectful acts (270, 292-296). For example, maternal perinatal smoking is associated with an increase in the risk of substantiated childhood maltreatment (χ^2 = 26.7, p < 0.0001) and doubles the risk of later cannabis use disorders in offspring. Early prevention and/or treatment of these symptoms mayreduce the incidence of both childhood maltreatment and subsequent outcomes (477). For example, a randomised trial involving home visitation has demonstrated positive effect on childhood maltreatment incident reduction, improved parent-child interaction, improved maternal depression, and overall child cognition, health and safety (477). However, cost and other implementation constraints are relevant for its adoption and practicability (403, 477). Interestingly, the impact of childhood maltreatment is independent of multiple factors that might have plausibly confounded or mediated the outcomes.

Clinical interventions

Clinical interventions (488, 489) such as pharmacotherapy, psychotherapy (490), Cognitive Behavioural Therapy (403) and Trauma-Focused Cognitive Behavioural Therapy (491) may improve child outcomes. Clinical interventions are indicated by persistent findings of the impact of maltreatment despite controlling for factors found to confound or mediate the associations. Indeed, in clinical settings, up to 32–54% traumatised children have improved from chronic depression in response to either pharmacotherapy (490, 492) or the combination of pharmacotherapy and psychotherapy when compared to nontraumatised children (490). This points to the importance of tertiary interventions. Maltreated children less likely respond to standard therapies (490, 492), or, are more likely to drop out from interventions (493, 494), itself a cause for concern. Finally, the rate of mortality is high in those with multiple health events and subsequent depression (495), especially in maltreated children, implying the need to strengthen potential, time-sensitive interventions (496). However, high cost and lower than intended levels of benefits are common disadvantages of such interventions (403).

Multisectoral collaboration

Nationally, these findings provide well-established longitudinal evidence on the impacts of childhood maltreatment and may help guide the implementation of a 12-year (2009–20) streamlined Australia's National Framework for childhood maltreatment prevention (59). It also has

implications in strengthening CPS systems to explicitly identify and record all potentially co-occurring forms of childhood maltreatment. Consistently, the rate of substantiation of childhood maltreatment has increased in Australia in recent years (121) perhaps due to an increase in the awareness of the impacts of maltreatment by key stakeholders (121, 122, 151) and amendment of child safety laws (152). The national plan emphasises major public health initiatives including prevention of family violence and subsequent breakdown, as well as the provision of support for families with common mental health problems and helping families maintain healthy lifestyles (e.g., alcohol and cigarette control) (59). These interventions tend to target potential outcomes rather than the mere identification of these risk factors (121).

Broadly, safe, stable, nurturing relationships and environments, as well as enhanced SES, improved parenting skills and access to better health services prevent childhood maltreatment (497). This suggests the continued importance of *ecologically-driven* (486, 487) primary prevention of childhood maltreatment. This may be backed by adopting a survey method that uses self-reports of childhood maltreatment experiences, subsequently ascertained by large scale surveys. Unfortunately administrative services only detect small proportions of maltreated children (497). This may further be augmented by continued monitoring and evaluation of effective public health intervention (497).

Increased global awareness of the need for integrated services may also reduce the magnitude of childhood maltreatment (419). This may enhance achieving the Sustainable Development Goal of eliminating violence against children by 2030 (498). For example, a coordinated multisectoral approach has been shown to reduce the magnitude of sexual abuse by 40% from 1900–2000 in the US (499). However, this requires an evidence-based approach which trades-off the cost and unintended consequences of an intervention against the benefits likely to be derived (497). Finally, the WHO's INSPIRE package depicts seven strategies to prevent violence against children at all levels, with policy and practice implications. The package represents Implementation and enforcement of laws, Norms and values, Save environments, Parent and caregiver support, Income and economic strengthening, Response and support services, and Education and life skills (500), and may help achieve Sustainable Development Goal (target 16.2) (498). It is designed to be effectively implemented through a thorough multisectoral collaboration, and sustained monitoring and evaluation. This may involve a broad based public health approach (501, 502). Sustainable interventions can be enhanced through collaboration (503, 504), and can be mainstreamed through effective use of public media (505, 506). This helps expand effective prevention and treatment options (390), but at a cost which needs to be determined.

Future research directions

There is emerging evidence on the public health and clinical challenges for cases of childhood maltreatment that may not reach acceptable clinical criteria. These involve childhood traumas with shared characteristics with maltreated cases (141). There is a need for the adoption of a uniform definition and comprehensive assessment (1, 130) to precisely identify cases (98). However, this may be underutilised by professionals due to lack of training, diagnostic uncertainty and minimal subsequent action (47, 507, 508). For example, although 2–10% of paediatric emergency admissions are associated with childhood maltreatment (509), it is less likely to be diagnosed due to its overlap with other forms of injury (9, 47). The recently developed ICD-11 and DSM-5 framework (101) may provide more consistent operationalisation and help to address this problem. Although the very definition of what constitutes childhood maltreatment is imprecise (101), consistent use of guidelines (510), adequate training, supervision and fidelity (481) will increase detection of childhood maltreatment (481, 510). Moreover, little is known about intergenerational transmission (86, 138, 511) and insecure attachment in maltreated children (512)– known risk factors for childhood maltreatment (16, 268).

There is little known about the risk and protective factors which may contribute to the impacts of maltreatment (513-515). That said, there is little known about those maltreated children with subsequent symptoms but who are still functional (516). Research targeting these different factors, including genetic and epigenetic mechanisms backed by technology such as neuroimaging, techniques is needed (431), especially from a developmental psychopathology perspective (415, 516). That perhaps involves examination of factors involved in, and mechanisms associated with, resilience of maltreated children (415, 516). As a result, there has been a call for methodologically robust studies specifically focussing on the *triads* of resilience factors (517) to build resiliency at different levels (415). These include dispositional/temperamental attributes of the child (e.g., responsiveness, independence, intellectual ability), a warm and secure family relationship, and the availability of extrafamilial support (e.g., peers, teachers) (415).

More studies are specifically required to establish the genes involved in the ontology of, and resilience to, the impacts of childhood maltreatment. That is, a continued research for risk and protective factors (389), as well as overlap of genotypes and phenotypes in the genesis of adverse impacts is important. In addition, more research with robust statistical methods (518) is needed on the neurobiological effects of childhood maltreatment (519), and maltreatment and gene interaction to replicate the previous non-conclusive findings and/or to find out other potential pathways that put maltreated children at greater risk (164, 520-522). Long-term studies identifying neurophysiological correlates of maltreatment (523), and exploration of efficacious intervention, particularly with

demonstrated clinical trials (524), to guide more focussed (525) and efficacious (522) interventions, are needed.

Conclusions

This is a robust, longitudinal study that improves the understanding of the field of childhood maltreatment by investigating the multi-system, synergistic and separate negative impacts of specific types and multiple forms as well as multiple incidents of substantiated childhood maltreatment, for long-term, multiple outcomes. This involves consistent and independent association between maltreatment and a broad range of adverse outcomes in young adults including victimisation to different forms of IPV, delinquent behaviour, RSBs and adverse pregnancy outcomes. The impacts also involve a range of substance use and mental health disorders such as IDU, cannabis use disorders, psychotic experiences and psychosis. Childhood maltreatment is also associated with height stunting, higher rate of dietary fat intake, poor sleep quality and asthma, as well as lower QoL. Gender difference has little effect except for delinquent and IDU outcomes. However, apart from its specific impact on physical IPV victimisation, cumulative risk of RSBs and higher rates of youth pregnancy in females, CSA is not associated with other outcomes. It is also important to note that the majority of maltreated children do not experience later adverse outcomes.

However, the pathway into these outcomes is complex and multiple, and needs further research to examine possible underpinning mechanisms that link exposure to childhood maltreatment and later outcomes, which could also address the peculiar characteristics of those who have experienced childhood maltreatment but who do not experience negative outcomes. That is, further information on resilience factors that help prevent adverse outcomes for the majority of maltreated children might inform future preventive strategies. This may include effective identification of the epigenetic mechanisms involved both in the pathogenesis and resiliency processes of childhood maltreatment. Moreover, circumstances in less developed countries may differ and a similar study is needed to address this question. Evidence-based primary intervention approaches, which trade-off the cost and unintended consequences against the benefits likely to be derived, are significant public health efforts that may prevent childhood maltreatment and also reduce the risk for, or effectively treat, later adverse consequences. Epidemiological documentation of childhood maltreatment experiences globally may help understand and allocate relevant resources for such effective interventions.

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Appendices

Appendix 1 – Flow of the study

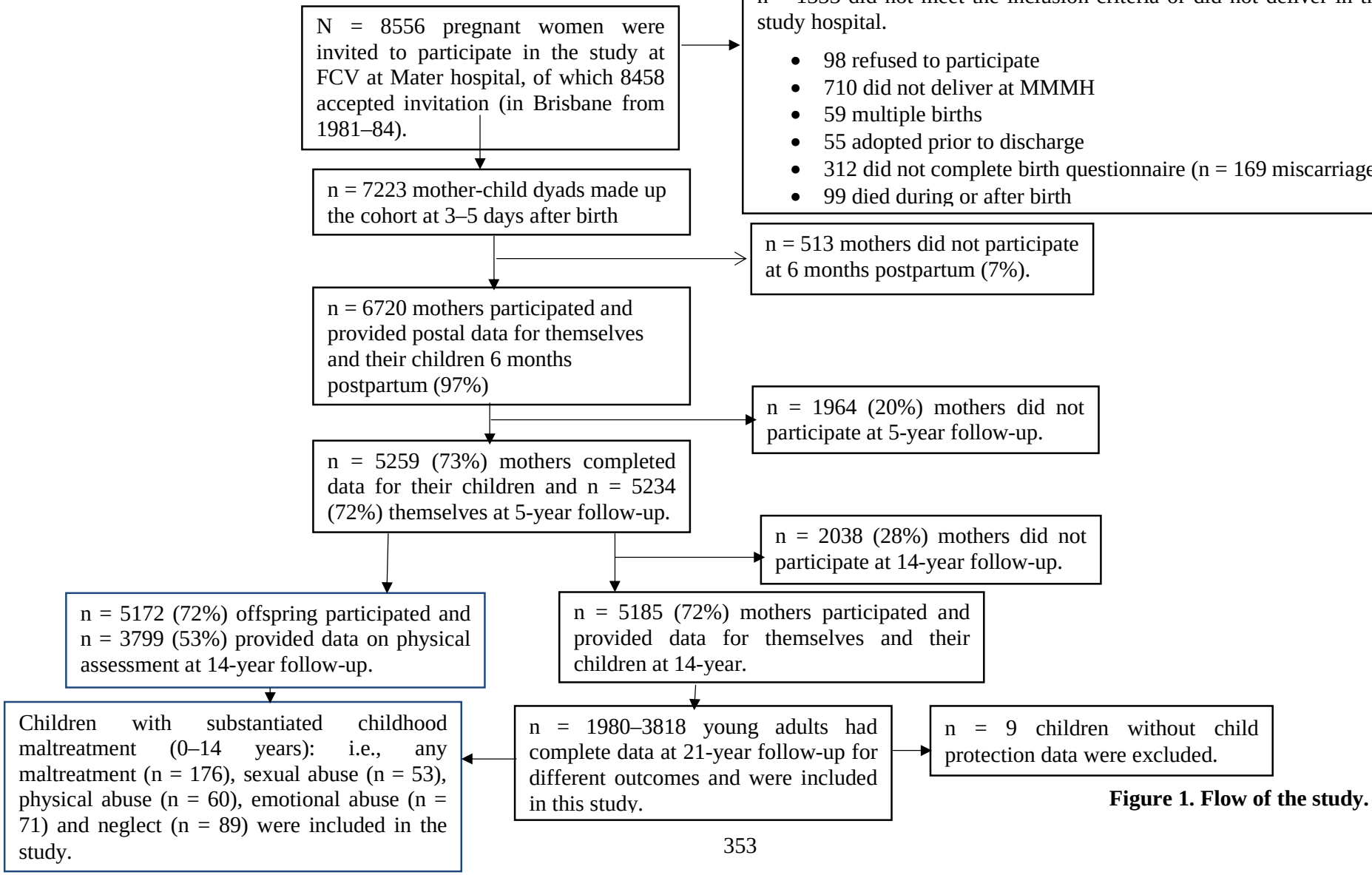

Figure 1. Flow of the study.

Appendix 2 – Prevalence of childhood maltreatment in the MUSP

Table 2. Distribution of childhood maltreatment substantiation by gender (n = 7214).

Childhood maltreatment type	Total number	Male %	Female %	X^2 (df = 1), *p*-value
Any				
No	6262	51.3	48.7	1.99 (0.158)
Yes	496	48.0	52.0	
Sexual abuse				
No	6615	51.6	48.4	37.44 (< 0.0001)
Yes	141	25.5	74.5	
Physical abuse				
No	6478	50.9	49.1	0.40 (0.527)
Yes	278	52.9	47.1	
Emotional abuse				
No	6498	51.1	48.9	0.51 (0.474)
Yes	258	48.8	51.2	
Neglect				
No	6493	51.1	48.9	0.28 (0.598)
Yes	263	49.4	50.6	

Appendix 3 – Description of selected outcome measures

Table 3. CAS items and subscales used in IPV victimisation study.

Physical IPV victimisation
Slapped me
Threatened to hit me or throw something at me
Pushed, grabbed or shoved me
Hit or tried to hit me with something
Kicked me, bit me or hit with a fist
Cronbach's alpha = 0.93
Emotional IPV victimisation
Told me that I wasn't good enough
Tried to turn my family, friends and/or children against me
Blamed me for causing his/her violent behaviour
Tried to keep me from seeing or talking to my family
Became upset if dinner/housework wasn't done when they thought it should be
Tried to turn my family, friends and children against me
Told me that I was stupid
Told me that no one else would ever want me
Told me that I was ugly
Tried to keep me from seeing or talking to my family
Tried to convince my family, friends and children that I was crazy
Cronbach's alpha = 0.91
Harassment
Harassed me over the telephone
Followed me
Hung around outside my house
Harassed me at work
Cronbach's alpha = 0.83
Severe combined abuse
Used a knife or gun or other weapon
Rape me
Cronbach's alpha = 0.62

Table 4. Items used to measure PDI, fat intake (SFQ) and PSQI at 21-year follow-up.

S. No.	PDI (n = 3729)	SFQ (n = 3766)	PSQI (n = 3778)
1	Feel as if people seem to drop hints about you or say things with a double meaning	Eat fried food with a batter or breadcrumb coating	Number of hours of actual sleep each day/night in the past month, in general
2	Feel as if things in magazines or on TV were written especially for you	Eat gravy, cream sauces or cheese sauce	Waking during the night
3	Feel as if some people are not what they seem to be	Add butter, margarine, oil or sour cream to vegetables, cooked rice or spaghetti	Snoring
4	Feel as if you are being persecuted in some way	Eat vegetables that are fried or roasted with fat or oil (this will include stir fry's)	Restlessness in sleep
5	Feel as if there is a conspiracy against you	Eat sausages, Devon, salamis, meat pies, hamburgers or bacon	Daytime drowsiness
6	Feel as if you are or destined to be someone very important	Eat chips or French fries	Overall sleep quality during the past month
7	Feel that you are a very special or unusual person	Eat pastries, cakes, sweet biscuits or croissants	Use of medicine (prescribed or "over the counter")to get sleep during the past month
8	Feel that you are especially close to God	Eat chocolate, chocolate biscuits or sweet snack bars	Trouble staying awake while driving, eating meals, or engaging in social

			activity during the past month
	Table 4 Continued…		
9	Think that people can communicate telepathically	Eat potato crisps, corn chips or nuts	Problem to keep up enough enthusiasm to get things done during the past month
10	Feel as if electrical devices such as computers can influence the way you think	Eat cream	*Cronbach's alpha* = 0.80
11	Feel as if you have been chosen by God in some way	Eat ice cream	
12	Believe in the power of witchcraft, voodoo or the occult	Eat cheddar, edam or other hard cheese, cream cheese, or cheese like camembert	
13	Often worried that your partner may be unfaithful	Way how meat usually cooked	
14	Feel that you have sinned more than the average person	Way how butter/margarine spread on bread	
15	Feel that people look at you oddly because of your appearance	Type of milk to drink or use in cooking or tea and coffee	
16	Feel as if you had no thoughts in your head at all	Amount of skin on chicken consumed	

	Table 4 Continued…	Amount of fat on meat consumed
17	Feel as if the world is about to end	
	thoughts ever feel alien to you in some way	*Cronbach's alpha* = 0.81
19	Thoughts ever been so vivid that you were worried other people would hear them	
20	Feel as if your own thoughts were being echoed back to you	
21	Feel as if you are a robot or zombie without a will of your own	
	Cronbach's alpha = 0.80	

Table 5. Items involved in QoL measurement.

Items	Response options
How satisfied are you with your life as a whole these days? What would you say you are?	Very satisfied Satisfied Dissatisfied Very dissatisfied
How would you say you feel these days? Would you say you are:	Very happy Fairly happy Not too happy Very unhappy
I feel lonely	Not true Somewhat or sometimes true Very true or often true
I worry about my future	Not true Somewhat or sometimes true Very true or often true
I feel worthless or inferior	Not true Somewhat or sometimes true Very true or often true
I worry a lot	Not true Somewhat or sometimes true Very true or often true
	Cronbach's alpha= 0.80

Appendix 4 – Distribution of confounders by childhood maltreatment,covariates by selected outcomes at 21-year follow-up and measurements of some confounders/covariates

Table 6. Confounding variables by any childhood maltreatment.

Confounding variables	**Total number**	**Any childhood maltreatment**		X^2 **(df = 1),** ***p*****-value**	**Phase of follow-up (FU): at (by)**
		No	**Yes**		
Maternal/familial					
Age (in years)					
20+	6033	94.1	5.9	80.5	FCV
13–19	1181	86.7	13.2	(< 0.0001)	
Combined maternal or paternal racial origin					
White	6250	93.1	6.9		FCV
Non-white	751	90.8	9.2	5.5 (0.019)	
Education					
High school+	5857	94.4	5.6	101.1	FCV
Incomplete high school	1304	86.5	13.5	(< 0.0001)	
Marital status					
Married	5380	95.1	4.9	156.36	FCV
Single-separated-divorced-widowed	1771	86.3	13.7	(< 0.0001)	
Income up to 5-years*					FCV to 5-year FU
Consistent poverty	215	85.6	14.4	47.23	
Mid-income	3425	94.7	5.3	(< 0.0001)	
High-income	473	98.3	1.7		
Cigarette smoking					
No	2471	96.9	3.1	32.94	FCVand 6
Yes	1273	92.8	7.2	(< 0.0001)	month FU
Maternal alcohol use					
No	4570	94.9	5.1	6.77 (0.009)	FCV and 6
Yes	664	89.5	10.5		month FU
DSSI depressive symptoms					
No	6665	93.4	6.6	43.95	

Table 6 Continued…					
Yes	411	98.5	1.5	(< 0.0001)	FCV, 3–5 days postpartum and 6 month FU
Chronic stress over the first 6 months					
Nil	4596	94.6	6.4	12.29	FCV to 6
Some symptoms	940	94.2	6.8	(0.002)	month FU
Lots of symptoms	562	89.7	10.3		
NLEs					
0-3	3955	95.5	4.5	51.63	5-year FU
4+	562	88.3	11.7	(< 0.0001)	
Social network					
High	2834	95.2	4.8	2.49 (0.114)	5-year FU
Low	239	92.9	7.1		
Arrest for any offenses					
No	4887	94.7	5.3	22.8	5-year FU
Yes	163	85.9	14.1	(< 0.0001)	
Mother's partner same as birth of child to 14 years					
Yes	3070	97.5	2.5	152.8	14-year
No	1613	89.4	10.6	(< 0.0001)	FU
Violence at home					
Low	3743	96.0	4.0	61.69	14-year
Higher	525	94.5	5.5	(< 0.0001)	FU
Child related variables					
Gestational age (in weeks)					At
≥ 37	3636	95.7	4.3	7.32 (0.007)	birth/medi
< 37	142	90.8	9.2		cal records
Birth weight (in grams)					At
≥ 2500	3631	95.8	4.2	17.79	birth/medi
< 2500	146	88.4	11.6	(< 0.0001)	cal records

Table 6 Continued…					
Breastfeeding					
No	2990	96.2	3.8	10.21	6 month
Yes	644	93.3	6.7	(0.001)	FU
Parental supervision					
Controlled	377	93.3	7.7	3.5 (0.061)	5-year FU
Some/lots freedom	4723	94.6	5.4		
Cigarette smoking					
No	4725	93.1	6.9	133.33	14-year
Yes	426	81.3	18.7	(< 0.0001)	FU
Alcohol use					
No	4643	88.5	11.5	(< 0.0001)	14-year
Yes	415	79.9	20.1		FU
CBCL-ADHD					
Normal	4589	94.2	5.8	72.02	14-year
Top 10%	644	98.6	1.4	(< 0.0001)	FU
CBCL-aggression					
Normal	4308	91.4	8.6	64.29	14-year
10% range	447	76.3	23.7	(< 0.0001)	FU

Table 7. Covariates by asthma/sleep quality outcomes at 21-year follow-up.

Variables	Total number	% (No)	% (Yes)	X^2 (df = 1), *p*-value
Skin problems				
Few a week	2323	63.9	36.9	12.68 (<0.0001)
Every day	1275	69.8	30.2	
Cigarette smoking				
No	2396	28.9	71.1	2.60 (0.11)
Yes	1362	26.5	73.5	
Alcohol use				
Abstainer	3505	27.9	72.1	0.29 (0.06)
Light–heavy	257	29.6	70.4	
Internalising				
No	3463	32.5	67.5	84.2 (<0.0001)
Yes	381	9.7	90.3	
CES-D depression				
No	2805	67.9	32.1	64.68 (<0.0001)
Yes	893	53.2	46.8	
Externalising				
No	3495	31.8	68.2	44.25 (<0.0001)
Yes	349	14.6	85.4	
BMI				
Normal	1712	67.9	32.1	17.10 (<0.0001)
Overweight	885	59.8	40.2	
Residential problem area				
No	3395	29.1	70.9	18.31 (< 0.0001)
Yes	354	18.4	81.6	
Reception of social security benefits				
No	2398	78.2	21.8	4.57 (0.033)
Yes	1332	82.3	17.7	
Education				
High school+	786	86.8	13.2	2.08 (0.149)

Table 7 Continued…				
Incomplete high school	2964	84.9	15.1	
Income (A$)				
160+	2972	89.4	10.6	5.17 (0.023)
0–159	755	92.2	7.8	
Marital status				
Never married	2944	87.9	12.1	26.83 (< 0.0001)
Living together-married-separated-divorced-widowed	820	78.5	21.5	

Table 8. CBCL aggression at 14-year follow-up.

S. No.	Items
1	Argues a lot
2	Demands a lot of attention
3	Destroys his/her own things
4	Destroys others things
5	Disobedient at home
6	Gets in to many fights
7	Screams a lot
8	Stubborn, sullen or irritable
9	Sudden changes in mood or feelings
10	Temper tantrums or hot temper
	Cronbach's alpha = 0.85

Table 9. Maternal report on internalising at 14- (YSR) and at 21- (YASR) year follow-ups.

S. No.	Subscales	14-year	21-year
	Anxiety/depression		
1	Feel lonely	+	+
2	Cry a lot	+	+
3	Deliberately try to hurt/kill myself	+	+
4	Afraid of doing something bad	+	+
5	Feel have to be perfect	+	+
6	Feel no one loves him or her	+	+
7	Feel others are out to get him/her	+	+
8	Feel worthless or inferior	+	+
9	Nervous or tense	+	+
10	Fearful or anxious	+	+
11	Feels too guilty	+	+
12	Self-conscious or easily embarrassed	+	+
13	Unhappy, sad or depressed	+	+
14	Worry a lot	+	+
15	Confused or in a fog	-	+
16	Too concerned with appearance	-	+
17	Worry about relations with opposite sex	-	+
18	Suspicious	+	-
19	Think about killing myself	+	-
	Cronbach's alpha	0.84	0.91
	Withdrawn		
1	Likes to be alone	+	+
2	Refuse to talk	+	+
3	Secretive or keep things to self	+	+
4	Shy	+	-
5	Do not have much energy	+	-
6	Unhappy, sad or depressed	+	+
7	Keep from getting involved with others	+	+

8	Not liked by others	-	+
	Cronbach's alpha	0.62	0.72

Table 9 Continued…

	Somatic	
1	Feel dizzy	+
2	Overtired	+
3	Aches or pains	+
4	Headaches	+
5	Nausea, feel sick	+
6	Problems with eyes	+
7	Rashes skin problems	+
8	Stomach aches cramps	+
9	Vomiting throwing up	+
Cronbach's alpha = 0.70		

Table 10. Young adult CES-D at 21-year.

S. No.	Items	S. No.	Items
1	Bothered by things which don't bother normally	11	Sleep was restless
2	Did not feel like eating: had poor appetite	12	Felt happy
3	Could not shake off the blues even with help from family or friends	13	Talked less than usual
4	Felt just as good as other people	14	Felt lonely
5	Had trouble keeping my mind on what I was doing	15	People were unfriendly
6	Felt depressed	16	Enjoyed life
7	Felt everything I did was an effort	17	Had crying spells
8	Felt hopeful about the future	18	Felt sad
9	Thought my life had been a failure	19	Felt other people disliked me
10	Felt fearful	20	Could not get 'going'
Cronbach's alpha = 0.88			

Appendix 5 – Meta-analysis: study quality assement criteria and some extracted data

Table 21. Study quality assessment criteria and respective scores for the meta-analysis.

Criteria	Score
Representativeness of study participants to source population	Population-based; all cases in a defined catchment area over a defined time; group institutions (e.g., hospitals or schools) = 1
	Selected group, volunteers or no description = 0
Ascertainment of CSA	Data obtained prospectively = 1; Data obtained retrospectively = 0
Selection of comparator	Drawn from the same study population = 1
	Drawn from another source population or no description = 0
Assessment of CSA	Substantiated by CPS = 1
	Self-report or no description = 0
Case definition of CSA	WHO definitions of child maltreatment or court-substantiated abuse or Barnett-Cicchetti Maltreatment Classification System = 1
	Self-report using questionnaires or operational definitions by researcher/s = 0
Assessment of RSBs	Structured measurement or clinical tests using biological samples = 1
	Self-report or no description = 0
Adequacy of follow-up (for longitudinal) or response rate (for cross-sectional) studies	Follow-up or response rate ≥ 80% with description for lost to follow-up = 1
	Follow-up or response rate < 80% = 0
Appropriate statistical method	Yes = 1; No = 0
Adjustment for possible confounders	Yes = 1; No = 0
Source of funding declared	Yes = 1; No = 0

Table 32. Descriptive characteristics of included studies in meta-analysis.

Authors and Year	Study Country	Study design	Data Points	Total sample	Gender		Age at CSA assessment (years)	CSA measurement	Assessment of RSBs	Age at RSB assessment (years)	% CSA		% RSB		Quality score
					Male n, %	Female n, %					Male	Female	Male	Female	
Zierler et al. (1991)	UK	Longitudinal	2	164	81, 49.4	83, 51.6	NI	SR	SR	18–45+	9.4	19.8	14.8	31.3	7
Lodico and DiClemente (1994)	USA	CS	N/A	5290	2708, 51.1	2582, 49.9	NI	SR	SR	-	17.2	1.2	6.9	8.7	5
Shrier et al. (1998)	USA	CS	N/A	7884	3953, 51.1	3931, 49.9	< mean age of 16.1	SR	SR	≤ 12 or ≥ 18	10.0	30.0		40.0	5
Bensley et al. (2000)	USA	CS	N/A	3473	1504, 49.3	1969, 50.7	< 18	SR	SR	18–50+	4.6	13.8	19.3	17.8	5
Wislon and Widom (2008)	USA	Longitudinal	3	1070	488, 45.6	582, 54.4	≤ 11	substantiated CPS record	SR	29	6.0	22.6	30.3	27.6	9
Haydon et al.	USA	Lon	4	8922	3967,	4955,	< 18	SR	SR and	24–32	2.1	7.0	3.6	6.1	6

(2011)			gitudinal			44.5	45.5			laboratory test						
Agardh et al. (2014)		Uganda	CS	N/A	980	633, 64.6	347, 35.4	NI	SR	SR	≥ 24	29.9	33.1	30.0	56.7	5
Richter et al. (2014)		Tanzania, Zimbabwe, and South Africa	CS	N/A	11,206	4944, 44.1	6262, 55.9	< 12	SR	SR	18–32	2.7	3.4	35.2	48.5	5

CM = childhood maltreatment; CS = cross-sectional; N/A = not applicable; N/I = not indicated; SR = self-report

Note: All included studies reported adjusted ORs for sociodemographic characteristics, and some studies additionally adjusted for other adversities.

Appendix 6 – Copy of ethics approval letter for this study

THE UNIVERSITY OF QUEENSLAND

Institutional Human Research Ethics Approval

Project Title:	Life Course Outcomes for Children Exposed to Adversity and Trauma in the Antenatal and Postnatal Period: a Longitudinal Study
Chief Investigator:	Mr Amanuel Alemu Abajobir
Supervisor:	Prof Jake Najman, Prof Gail Williams, Prof Steve Kisely
Co-Investigator(s):	Prof Jake Najman, Prof Gail Williams, Prof Steve Kisely
School(s):	School of Public Health
Approval Number:	2015001524
Granting Agency/Degree:	PhD
Duration:	30th April 2019

Comments/Conditions:

Note: if this approval is for amendments to an already approved protocol for which a UQ Clinical Trials Protection/Insurance Form was originally submitted, then the researchers must directly notify the UQ Insurance Office of any changes to that Form and Participant Information Sheets & Consent Forms as a result of the amendments, before action.

Name of responsible Committee:
Behavioural & Social Sciences Ethical Review Committee
This project complies with the provisions contained in the *National Statement on Ethical Conduct in Human Research* and complies with the regulations governing experimentation on humans.

Name of Ethics Committee representative:
Associate Professor John McLean
Chairperson
Behavioural & Social Sciences Ethical Review Committee

Signature _____ Date 19/10/2015

THE UNIVERSITY OF QUEENSLAND
AUSTRALIA

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Additional Notes to Ethics Approval

1. The clearance number should be quoted on the protocol coversheet when applying to a granting agency and in any correspondence relating to ethical clearance.

2. Clearance will normally be for the duration of the project unless otherwise stated in the institutional clearance form.

3. Adverse reaction to treatment by subjects, injury, or any other incidents affecting the welfare and/or health of subjects attributable to the research should be promptly reported to the Head of School, the Occupational Health & Safety Unit, and the Ethics Committee.

4. Amendments to any part of the approved protocol (including change of Investigator/s), documents, or questionnaires attached to the clearance must be submitted to the Ethics Committee for approval.

5. Unforeseen events that might affect continued ethical acceptability of the project must be immediately reported to the Ethics Committee.

6. Discontinuation of the project before the expected date of completion must be reported to the Ethics Committee, giving reasons.

7. The Chief/Principal Investigator/s are responsible and accountable for full compliance of the protocol by all investigators.

8. The Committee reserves the right to visit the research site and view materials at any time, and to conduct a full audit of the project.

9. It is the Committee's expectation, whenever possible, that work should result in publication. The Committee would require details to be submitted for our records.

10. Staff and students are encouraged to contact either the Ethics Officer (3365 3924), or Chairperson on other issues concerning the conduct of experimentation/research (e.g., involvement of children, informed consent) prior to commencement of the project and throughout the course of the study.